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EXPLORATIONS AND SURVEYS FOR A RAILROAD ROUTE FROM THE MISSISSIPPI RIVER TO THE PACIFIC OCEAN.

WAR DEPARTMENT.

ROUTES IN CALIFORNIA, TO CONNECT WITH THE ROUTES NEAR THE THIRTY-FIFTH AND THIRTY-SECOND PARALLELS, EXPLORED BY LIEUT. R. S. WILLIAMSON, CORPS OF TOPOGRAPHICAL ENGINEERS, IN 1853.

REPORT.

WASHINGTON, D. C.
1855.

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* From original sketches in the field by Mr. Charles Koppel.

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ORGANIZATION OF PARTY.

The instructions from the War Department were received by me on the day after their date, and I immediately took steps for forming the party, and collecting the material necessary for the successful prosecution of the duties assigned to me; and knowing the importance of the utmost despatch, as the season must necessarily be far advanced before we could reach California, I deferred all the preparations that could be made while the outfit was being prepared, and taking with me only such instruments as I knew could not be procured there, I embarked with my party at New York on the 20th May, on board the steamer Illinois, bound for Aspinwall.

The party which embarked with me consisted of Lieutenant J. G. Parke, topographical engineers; Lieutenant G. B. Anderson, 2d dragoons; Dr. A. L. Heermann, physician and naturalist; Mr. Isaac Williams Smith, civil engineer; Mr. Charles Koppel, assistant civil engineer and artist; Mr. Charles Preuss, draughtsman. Lieutenant George Stoneman, 1st dragoons, who had been detailed to command my escort, was also on board.

It will be perceived that an important member of the party, the mineralogist and geologist, was absent. I had used every exertion to obtain one, writing to many persons who had been recommended to me, but could find no one to fill this important post. My only resource was to request Professor Spencer F. Baird, of the Smithsonian Institute, to endeavor to engage some one for me, who would follow at a later period. Thanks to the kindness of this gentleman, and much to my satisfaction, Mr. W. P. Blake was engaged, and he arrived at San Francisco a fortnight after us, and has since filled the vacant post.

The party arrived safely in San Francisco on the 20th of June, the only incident of note to us that occurred on the voyage being the illness of Lieutenant Anderson. This officer was attacked with fever shortly after leaving Panama, and arrived in San Francisco in a precarious state—so much so that the surgeon considered it would be dangerous for him to accompany us in the field. I therefore was forced to dispense with his services, but am happy to be able to state that he has since perfectly recovered.

I immediately repaired to Benicia, where preparations were at once commenced for fitting out the party. Such instruments as were required beyond those brought from New York were either obtained from the topographical office or purchased in San Francisco. A spring-wagon for their transportation was purchased. Four six-mule teams were furnished by the quarter-master for transportation of stores and baggage. Five teamsters and eight additional men for general duty as field-men and cooks were hired. In the mean time the escort had arrived, and it was found that to render it efficient it would be necessary to remount the men, whose horses, worn out in service, were condemned. Mules for this purpose were purchased by order of the

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commanding general of the division. In fine, all the preparations were completed, and the party ready to leave Benicia, on the 10th of July.

GENERAL REMARKS.

Before proceeding to give a detailed narrative of our work in the field, I think it would tend to a more clear understanding of the subject if I were to give a concise description of the great topographical features of the country about to be examined, and the main objects, as I understood them, to be attained by this survey.

Benicia, the depot where the party was fitted out, is the northernmost point mentioned in my instructions. This town is situated on the Straits of Carquines, through which the waters of the Sacramento and San Joaquin rivers flow into San Francisco bay and the Pacific. From these straits to the southward, following the general course of the coast, is a range of mountains, extending beyond the southern boundary of this State into the peninsula of Lower California. This range often presents the appearance of several ridges, sometimes parallel, sometimes nearly at right angles; but there is one line, or water-shed, nearly parallel to the coast, and distant from it from 50 to 70 miles, which is unbroken by any water-course from San Francisco bay to Lower California. From this water-shed numerous short streams flow, meandering between the spurs or secondary ridges of the one great and continuous range, and forming rich and fertile valleys. This range varies in height from 800 to 5,000 or 6,000 feet. It is generally known as the Coast range, and this will be understood as its meaning where this term is used in this report.

If from Benicia we travel due east for about 120 miles, we will be at the summit of a much higher range than the one last mentioned, and following its water-shed southwardly, we find it gradually approaches the coast, until, in latitude 35° 20′ N., it actually joins itself to the Coast range, and the two are blended into one.

This is the Sierra Nevada, and varies in height from 4,000 to 8,000 and 10,000 feet. These mountains have a numerous population of miners, and though they have not been examined instrumentally but at two or three points, they have been so thoroughly "prospected" by the miners, that it is well known in the latitude of Benicia they are high and rugged, whereas near their junction with the Coast range they are much lower.

Mr. Blake considers the mountains south of this point of junction as the prolongation of the Sierra Nevada rather than the Coast range, and in his report he has proposed the name *Bernardino Sierra* for that portion of the chain extending from the end of the Sierra Nevada to the peak of San Bernardino.

Between the western base of the Sierra and the eastern base of the Coast range is the vast plain of the San Joaquin and Tulare valleys, being 300 miles long, and averaging 65 miles in breadth. These valleys are well watered by numerous streams flowing from the Sierra, though not one of consequence reaches them from the Coast range. The result of this is, that the traveller going along the western side of these valleys will find no stream, while on the eastern side he will find one every few miles. In the southern part of the plain are several lakes, called the Tulare lakes, and hence this part receives the name of the Tulare valley; while farther north, the San Joaquin river, coming from the Sierra, flows through the middle of its valley—a continuation of the other—in a northwest direction, receiving numerous tributaries from the east.

To the east of both the Sierra and Coast range, the country is very little known, and very

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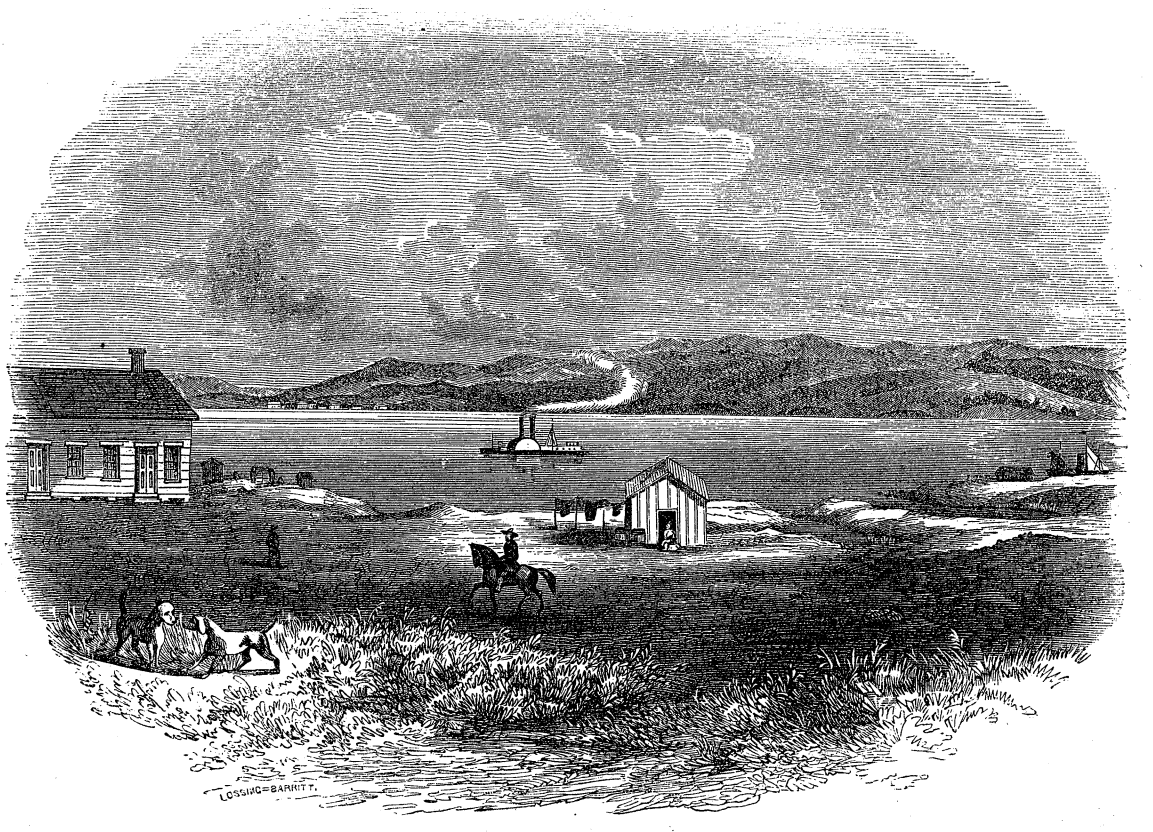
different accounts have been given of it by the few who have explored small portions of it. It has been represented by many as being in parts vast plains, while others, who have explored perhaps different parts, make it very broken and mountainous. No streams flow from it through the Coast range; and as most of the streams known to exist in it are known to lose themselves, it has been called, very properly, the "Great Basin."

It is evident that any railroad approaching the Pacific coast from the east must cross a portion of this Great Basin, when it will reach either the base of the Sierra Nevada or the Coast range, and, to reach the ocean, it must cross one or both of them. One main object of this survey is to ascertain if a railroad can cross the Sierra and Coast range; the other to explore the Great Basin, to ascertain its adaptability for such constructions.

As it is well known there is no impediment to the construction of a road to the Tulare valley from the waters of San Francisco bay, in order to accomplish the above objects I determined to proceed at once to the head of that valley, where the Sierra is supposed to be the lowest, and there examine all the passes leading into it.

FROM BENICIA TO LIVERMORE'S.

Benicia, formerly the capital of the State of California, is situated on the Straits of Carquines, which connect Suisun and San Pablo bays. It is on the north side of these straits, and is



STRAITS OF CARQUINES AND MARTINEZ, AS SEEN FROM BENICIA.

twenty-five miles above San Francisco. Adjoining the town is a military post and arsenal, and the principal depot of quartermaster and commissary stores for the department of the Pacific.

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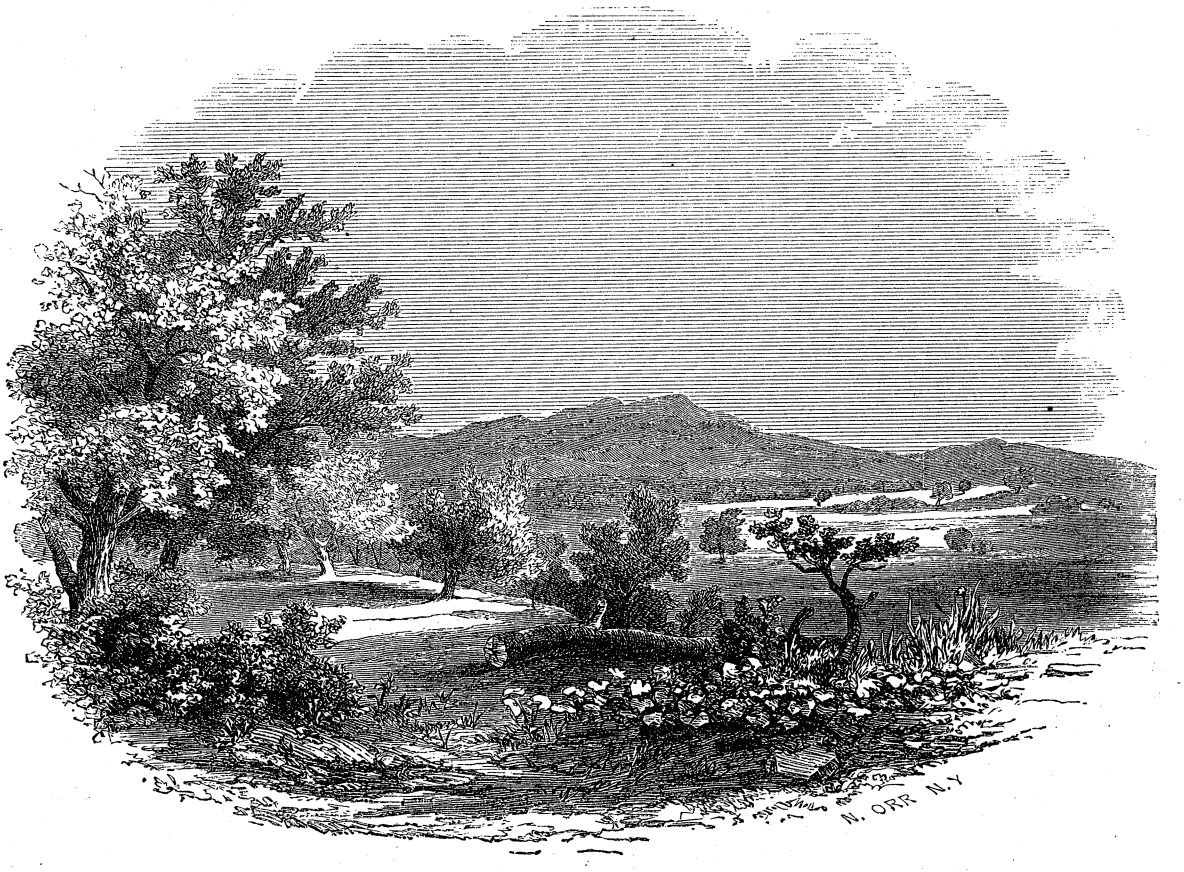
The depot and machine-shops of the Pacific Mail Steamship Company are also at this place. A view of a portion of the town and the landing is presented in Plate I. The double peak of Monte Diablo, distant fifteen miles, is seen in the background.

On the 10th of July I left Benicia, crossing my train and party to Martinez in the little ferry-boat which plies across the straits.

This town is situated in a pretty little valley, having a range of low hills on either hand—that on the east separating it from the San Joaquin valley. To reach this latter, from Martinez, on horizontal ground, would be very easy—following the shore of the bay and turning the point of hills. But this route would be rather circuitous, and I therefore preferred to take the ordinary road, and cross the Coast range more to the south, at a pass known as Livermore's; which pass I believed would, upon examination, prove a practicable one. The whole of the first day was occupied in crossing our teams and mules, and the next morning we moved, in a southeasterly direction, up the little creek upon which Martinez is built. To our left was Monte Diablo, a fine peak in the Coast range, and nearly 4,000 feet high—the highest for a long distance. At its base is the finest and most beautiful valley in this vicinity, about fifteen miles long and three or four broad. It is covered with oaks, and is somewhat celebrated for its excellent quarries of limestone.



MONTE DIABLO VALLEY.

In proceeding towards Livermore's valley, we have a range of hills on either hand; that on the right abounding in red-wood. Several saw-mills are established there, and supply San Francisco with large quantities of lumber. Our road was in the intermediate valley, which is

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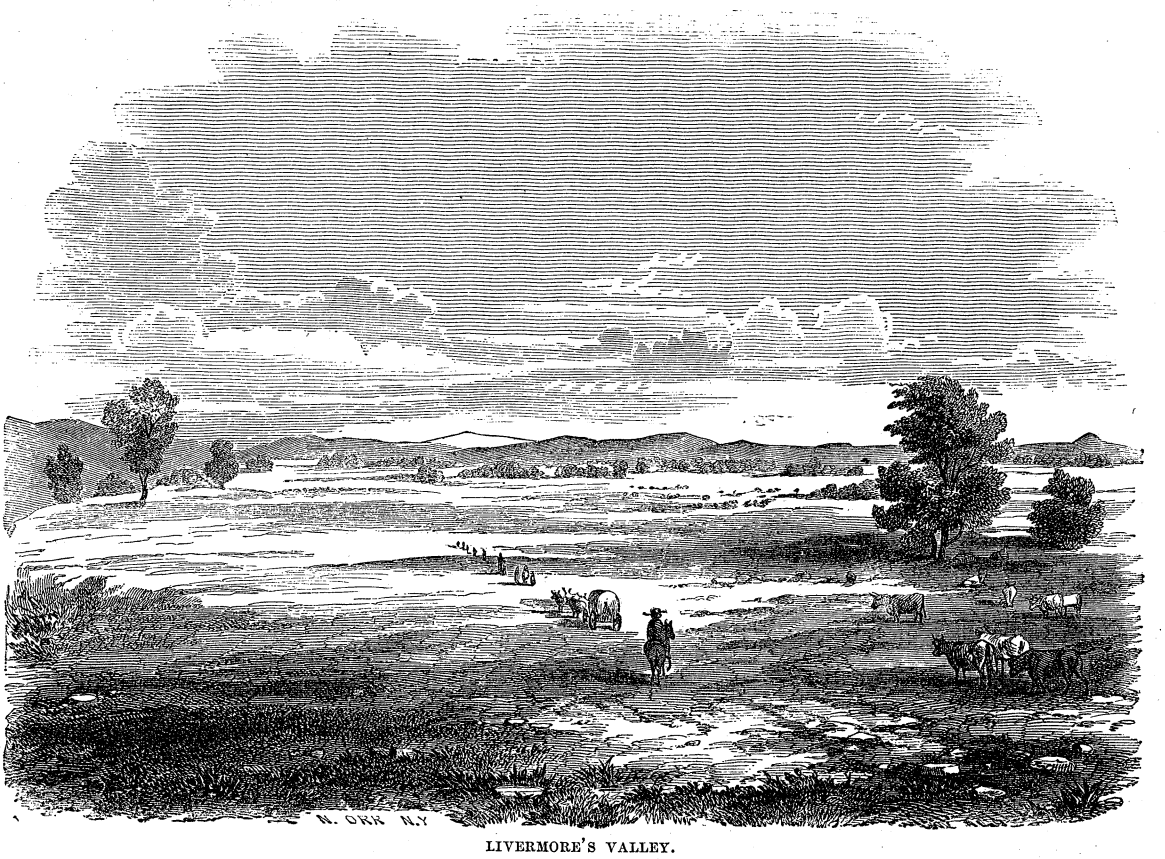
from one-half to two miles wide, and, to the eye, perfectly level. We are, however, at first ascending the little stream which waters Monte Diablo valley, and subsequently get upon ground descending in the contrary direction. The greater part of Livermore's valley is of a gravelly soil, and unfit for cultivation.

It is used principally as a cattle rancho, and numerous herds were grazing on different parts of the plain as we passed. This valley is about eleven miles long and six broad. A view of its surface is presented in the annexed wood-cut.



LIVERMORE'S VALLEY.

Several beds of streams intersect it, which in winter may be called rivers, but in summer are perfectly dry. The banks of these are well timbered with cotton-wood and oak, but elsewhere no timber is to be seen. Springs abound at the base of the hills. The waters of this valley accumulate at its western end, forming a lake, from which the water, after flowing through a cañon in the hills, finds its way to San Francisco bay.

LIVERMORE'S PASS.

On the afternoon of July 13 we reached Livermore's house, and encamped at a spring about a mile in its rear, and nearly four miles from the entrance of the pass. Here I determined to stop a sufficient length of time to enable me to make a survey of the pass, in which is the wagon-road usually travelled by those going from San José to the lower San Joaquin valley; and for this reason this pass is much better known than several others lying a little to the south of it. There is, however, good cause for supposing that some of these other passes are better adapted for a railroad than the one known as Livermore's. The hills here are destitute of

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timber, and in the spring covered with a luxuriant growth of wild oats. As the season advances, the rain ceases, and the burning sun converts the once green hills into barren-looking mounds. These hills are rounded, and so symmetrical as to give them an artificial appearance.

The three following days were consumed in making a survey of the pass. The spring-wagon was taken to carry the odometer, and the courses were taken with a prismatic compass, on a small tripod, while at every prominent point a reading of the barometer was taken. We found the entrance to the pass to be 481 feet above the level of the sea, and its summit 686 feet, while the altitude of the eastern base of the hills was but 89 feet. This gave a grade of about 60 feet in ascending from the west, and 87 feet in descending towards the east. There would be little difficulty in winding, and thus increasing this distance, to reduce those grades, should it be desirable. Upon reaching the summit, the wagon-road does not at once cross and commence the descent, but continues to ascend more than 200 feet more, in order to find better ground for wheeled vehicles. If it were desired to construct a railroad over these hills, I have little doubt that a proper examination would result in the discovery of much better places than this pass, although this is determined to be practicable. The rounded hills interlocking, cause the road to be exceedingly tortuous, and it would require a great deal of excavation and embankment to make curves with a sufficiently large radius.

SAN JOAQUIN VALLEY.

On the 17th we left camp early, and went through the pass with the wagons without much difficulty, and camped at the eastern base of the hills, near a solitary house, which is known as Elkhorn post office. From here we had, to the east, the broad expanse of the San Joaquin valley. The river had overflowed its banks, and the valley was one vast sheet of water, from 25 to 30 miles broad, and approaching within four to five miles of the hills. It had been my intention to cross at the lower ferry and follow up the eastern side of the valley; but this was evidently impossible. The first point on the river which presents banks high enough to prevent an overflow is at Grayson, one of the cities of California, which looks very well on paper, but in which there are but two houses at present. It is two or three miles above the mouth of the Tuolumne river, the principal branch of the San Joaquin, and 27 miles southeast of Elkhorn. About a mile above Grayson a ferry has been established, and here we crossed with our teams and animals, (the work of a whole day,) and camped on the Tuolumne, five or six miles from its mouth.

This river, as indeed are all the rivers flowing into the San Joaquin and the lakes, is fringed with trees. In the summer and autumn, when the water is low, these trees are 20 and 30 feet above the river; but in the spring, when the snow melts, the waters rise very rapidly, and often overflow their roots. Extensive side-channels or "sloughs" are thus formed, and these are most numerous near the mouths of the streams. On this account permanent bridges crossing these streams must be much longer than otherwise. There is no difficulty in finding good points for crossing. The Tuolumne would require a bridge from 200 to 300 feet. We followed up this river for 25 miles, when we struck the ordinary wagon-road, and thence proceeded to Fort Miller, a military post on the San Joaquin, in the foot-hills of the Sierra Nevada. As there is no doubt of the practicability of constructing a railroad to the extreme head of the Tulare valley, I do not think it expedient to enter into a detailed description of this vast plain, but refer to the few remarks at the commencement of this report, and the maps and tables accompanying it, for such geographical and topographical information as may be required.

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The plains between the streams are destitute of foliage, and the soil generally gravelly and poor. It is very dry in summer from the effects of the sun, but in winter it absorbs vast quantities of water, and becomes so soft as often to prevent the passage of vehicles, or even animals.

We were obliged to stay at Fort Miller a week, to have our wagons repaired, and to have many of our mules shod, there not having been time to do this at Benicia. We also here obtained an additional supply of provisions and quartermaster's stores. This post is distant, by the way we travelled, 174 miles from Martinez.

TULARE VALLEY.

Having completed all our arrangements on Saturday, July 30, the next day we bid good-bye to our friends at the fort, and long before daylight were on the road, to advance to King's river, over a dry, barren plain, on which not a drop of water was to be found; and the heat of the sun may be imagined, knowing the fact that the thermometer had stood the day previous at Fort Miller at 115° Fahrenheit in the shade. We had the pleasure of meeting on the road Mr. Senator Gwin, returning from a trip to the Tejon Pass, where he had been to examine personally the adaptation of the country for a railroad. King's river, called on many maps Lake Fork, is a deep and rapid stream, about eighty yards wide. When it first emerges from the mountains it divides itself into seven or eight different streams, which reunite near the place we struck it. From there to its delta near the lake it has only one bed. An American had established a ferry about twelve miles below our camp, and having marched there, we occupied the rest of the day in crossing.

The next stream we came to was the Pi-pi-yu-na, or Kah-wée-ya, and very commonly known as the Four Creeks. Immediately upon leaving the mountains, like King's river, it divides itself into several streams; but, unlike those of that river, they do not unite, but continue to diverge, forming a delta, whose base is over fifteen miles long. The whole of this delta is covered with a luxuriant growth of oak. The soil is rich, producing spontaneously many kinds of grasses. The contrast between this beautifully-green spot and the arid plains on each side is very striking. It is well shown by Plates IV and V, which are views taken from the same point. Plate IV is a view looking eastward towards the Sierra Nevada, whose snow-capped summits are seen in the distance, and the bottom land of the river, covered with timber, is seen in the foreground. Plate V is a view in the opposite direction, and shows the arid plains between the Kah-wée-ya and King's river.

The Kah-wée-ya is divided into four small streams where the road crosses, the extreme ones being four and a half miles apart. Two of them, though narrow, are quite deep, and required bridging.

This delta is fast filling up with American settlers. Already on the second creek is the town of Woodville, which, however, when we passed, contained but one house. Here I was fortunate enough to meet with Mr. Alexander Godey, a most excellent and experienced mountaineer, and who knew more, perhaps, about the mountain passes in the Sierra Nevada—which I was about to examine—than any one in the country. He had just returned from the Tejon, where he had been with the hope of meeting Mr. Edward Beale, superintendent of Indian affairs, who had been expected for some weeks. I proposed to him to accompany me, and he finally agreed, with the understanding that he was to be allowed to leave as soon as Mr. Beale should arrive.

Leaving Woodville, we continued in a southeast direction, travelling for seventy miles near the base of the mountains, and crossing numerous small streams, or dry beds of streams, when

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we came, August 6, to O-co-ya, or Pose creek, seven miles north of Kern river. We learned from Godey and others that on Kern river there was no grass, while here we had fine grass in abundance. We were now near the head of the valley, and the passes to be examined, and I therefore determined to select this point for a depot camp, from which future operations would be conducted.

DEPOT CAMP—FUTURE PLANS.

O-co-ya creek, at this season, is not here a running stream, but water in holes is found in abundance, and is very good. I am told it never fails entirely.

My plan was to go with a small party first to Walker's Pass, and having examined it from base to base, to return to the summit, and from thence follow, as closely as the configuration of the country would permit, the water-shed, or "backbone" of the mountains, till I had reached the point where the Sierra and Coast range unite. I would by this means be certain of seeing very deep depressions in the mountains. I would then endeavor to ascertain the accessibility of these depressions from either base. By this plan I supposed I would gain a good knowledge of the general character of the Sierra in this vicinity, and would be able to select judiciously the best passes for minute survey.

The question as to the comparative value of a barometric profile, as compared with one made from measurements with the level, was one that had never been answered definitely. We knew that the results would not coincide exactly, but the limit of probable error had not been determined. If, therefore, I should survey one or more of the passes with both instruments, and, comparing the results, find that they agreed closely, it would be presumptive evidence that those profiles, made from barometric measurements alone, would agree equally as close; whereas, if a great disagreement was found, it would show that the barometric profiles were not reliable. For these reasons I resolved to run a line of levels, from base to base of the Sierra, through one or more passes, as the results of the preliminary reconnaissance might determine. I was aware that this would occupy several weeks; but as the bearing of the result would not be upon the one pass only, but upon every one examined during the survey, and perhaps upon the barometric profiles of the other parties whose extended lines did not permit them to use the level, I believed the time could not be devoted to a better object.

While the preliminary examination was going on, the wagon-train was to return empty to Fort Miller, to obtain a further supply of provisions and barley, and Lieutenant Stoneman, with that portion of the escort not otherwise engaged, was to remain in Depot camp to guard the stores and other property left there.

On the morning of August 10, the wagon-train started from Fort Miller, and I, accompanied by Lieutenant Parke, Mr. Smith, civil engineer, Mr. Preuss, draughtsman, Mr. Godey, as guide, and five men of my party, started for the passes in the mountains. We had an escort of a corporal and nine men. We carried with us two barometers, besides the aneroid, a sextant, and the other usual instruments for a surveying party. In giving the result of the reconnaissance, I will, for more convenient reference, separate it under different heads, according to the pass to which the particular part may refer.

WALKER'S PASS.

Upon leaving camp we followed up Pose creek till it took a bend coming from the northeast, when we left it and took up a dry branch, with here and there a spring, our general course

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being a little north of east. We could see the open valley of Kern river to the south and southwest. Higher up, this river cañons; and it was to avoid this cañon that we were obliged to keep the ridge, where there is a good pack-trail, but impracticable for wagons. We camped in a little hollow in the mountain, and the barometer indicated the altitude above Depot camp to be 3,400 feet. As we had descended somewhat to find a camping-place, the highest point we passed over must have been over 4,000 feet above that camp, or nearly 5,000 feet above the level of the sea. Directly opposite us, on the other side of the river, was a mountain which we called Cañon mountain, still higher than the one we were on; and these two mountains, approaching each other with precipitous side-slopes, formed the cañon above mentioned.

The next day, after ascending a short distance, we began to descend. We could see the river far below us, white with foam, looking like a thread of silver as it dashed among the rocks with a very rapid current. There was the appearance of a large valley at the base of the mountain. Godey told us that the river there received a tributary, and that it was near the head of that stream that we should find Walker's Pass. The descent was very steep; so much so that in many places it was dangerous to ride, and it was more easy to slide down than to walk. We arrived on the banks of the river, at the base of the hill, just in time to allow me to get a series of circummeridian altitudes of the sun, about half a mile below the mouth of the branch.

The river was very rapid, and apparently deep. We tried to find a ford in several places, but did not succeed till we had gone up stream three miles; and here the water came nearly up to the mules' backs. To keep our packs dry we had to have them carried across by the men. After crossing, we went up the valley of the creek for four or five miles, and made a camp in fine grass on its banks. The valley is from one to three miles wide, with a poor soil, except in the bottoms near the creek, where the grass grows luxuriantly. Following up the valley, which averaged more than a mile in width, with a gentle ascent, gradually increasing all the way, we found, about twelve miles from the mouth of the creek, a small branch coming in from the south, now dry, but having apparently a long and wide valley. Five miles further, the creek, now a small brook, came from the mountains to the north, while from the southwest there was an open valley from a quarter to half a mile in width. This valley we followed up; and having arrived within a mile and a half of the summit, we were fortunate enough to find a fine spring and plenty of coarse grass. Here we made our camp; and, it being early in the afternoon, I rode up to the summit, where I had a fine view of the basin. There appeared to the eastward a strip, twenty or thirty miles wide, of unbroken ground; and beyond this the view was limited by masses of mountains. The pass is nowhere less than a quarter of a mile wide, and the ascent and descent both gradual. In fact, it is an excellent natural wagon-road. The mountains on either side are composed mostly of granite, and are rough and precipitous.

There were quite a number of Indians, both on the creek and at the spring near our camp. At first they fled, but soon gained confidence, and came into camp. They seemed at this season of the year to be principally employed in collecting a kind of bulrush or cane, upon the leaves of which is found a substance very like sugar, which to them is a not unimportant article of food. They cut the cane and spread it in the sun to dry, and afterwards, by threshing, separate the sugar from the leaf. The cane itself had no sweet taste. As the creek had no name that I knew of, I endeavored to ascertain its Indian name, and found it to be Chay-o-poo-ya-päh—the accent strong on the last syllable. This name I have adopted on the map. I understand it to mean the creek of the bulrushes.

The following day was occupied in examining the pass fully, and obtaining data for making

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a barometric profile. We descended from the summit more than eight miles, and found the belt of unbroken ground to extend as far as we could see along the base of the mountains, in both directions. I will now state the results of the subsequent calculations of our observations, from which an opinion of the practicability of the pass for railroad purposes may be formed.

Starting from Kern river, at the m uth of Chay-o-poo-ya-päh, and ascending to the point where the latter comes from the mountains, a distance of 17 miles, we have a gentle ascent, viz: $5\frac{3}{4}$ miles on a grade of 13 feet per mile, $6\frac{1}{4}$ miles of 29 feet per mile, and the remaining 5 miles at 17 feet per mile. From here over the summit to the point we reached in the basin is $16\frac{1}{4}$ miles, and this part may be considered the pass proper. Here the grades are of an entirely different character. We have for the first $6\frac{1}{2}$ miles (which brings us to our camp) an average grade of 272 feet to the mile—less than this at first, but gradually increasing as the summit is approached; from camp to the summit, $1\frac{1}{2}$ mile, at 428 feet per mile; and from the summit to the base of the mountains, $8\frac{1}{4}$ miles, at 265 feet per mile.

These steep grades, for so long a distance, would at once render this pass out of the question, even admitting them to be practicable, unless it can be shown that there is no better one, or that it has a pre-eminently favorable position.

That there are passes with better grades, will appear in the sequel. As to its position, I consider it one of the worst of all the known passes in the Sierra Nevada. As far as we know the country, (and its general features are well known,) the whole portion east of Walker's Pass, for two or three degrees of longitude, is a mountainous desert, almost destitute of wood, water, and grass. It is universally conceded that any road reaching this pass must have come either from the Vegas de Santa Clara, the Mohave river, or from the south. If coming from the Vegas, in anything like a direct course, the position of the pass would be preferable to one farther south; but this desert would have to be crossed, and the practicability of such a route is still a problem. For any road coming from the Mohave, or from the south, a pass farther south would possess a preferable position.

But suppose a road arrives at Walker's Pass, and, surmounting the obstacles of steep grades, enters the valley of the Chay-o-poo-ya-päh, and follows it down to Kern river; there is, then, no other course of proceeding open but to follow down this river, for the high mountains on each side afford no chance of a passage. The cañon before mentioned is said to be five miles long, and, according to information obtained from the Indians, the precipitous rocks, jutting into the stream first from one bank then from the other, preclude the possibility of even a foot-trail through it. It is probable, also, that here the river is very rapid. The point where we struck the river, near the mouth of Chay-o-poo-ya-päh, according to the barometer, is 2,600 feet above the level of the sea, and Kern lake, at the head of the Tulare valley, is but 400 feet. The distance, as taken from the map, is forty miles. Adding one-fourth for sinuosities, and we have an average grade of forty-four feet to the mile. The course of the stream is southwest, at right angles to the proper direction of a road that is to traverse the Tulare and San Joaquin valleys.

After due consideration of the foregoing facts, I think I am justified in saying that Walker's Pass is badly situated, and impracticable.

But many persons may naturally ask, Is this pass, here described, Walker's Pass? is this the pass which every one, two years ago, admitted to be an excellent one? It is due to me that this question s ould be answered.

Mr. Joseph Walker, from whom Walker's Pass takes its name, is an old mountaineer, and

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was, I believe, a trapper in California long before the first exploring parties were sent there. Of the minutiæ of his early history I know but little, but it is not relevant to the subject. He, however, in one of his numerous expeditions, found a very good pass in the Sierra Nevada, which he thought would answer admirably for a wagon-road. This he reported when he was in Missouri, or some one of the (now so-called) Eastern States. In August, 1845, Colonel Frémont started on an expedition to the Pacific, by the way of the headwaters of the Arkansas, White river, Great Salt lake, and Mary's or Humboldt river, and he engaged the services of Walker as guide. Mr. R. Kern, whose lamentable death with Captain Gunnison and party is known to all, was topographer or draughtsman to the expedition, as also was Mr. Charles Preuss. Mr. Alexander Godey, of whom Colonel Frémont speaks in the highest terms, was also of the party. When Colonel Frémont reached the eastern base of the Sierra Nevada, which he did in the vicinity of Walker's lake—say latitude 38° 30′ north—he found that his party would soon be out of provisions. He therefore separated from the main party, and proceeded as rapidly as possible to Sutter's Fort to obtain a supply of live stock, flour, &c., with the understanding that the main party, under Walker and Kern, were to follow southwardly the eastern base of the Sierra till they came to the pass Walker had discovered; and here, in the mountains, on a stream flowing west from the pass, they were to remain in camp till relieved by Colonel Frémont. At this time very little was known of this part of the country. Walker drew a rough sketch of the route to be pursued by Colonel Frémont in order to find his camp. The main point in his instructions was, that he should pass the San Joaquin river and continue on southeasterly till he came to a large stream. This he was to ascend till he found a branch coming in from the east, and in the valley of this branch he would find the camp.

Colonel Frémont succeeded in obtaining the provisions he required, and started in search of Kern and Walker. Following Walker's directions, he crossed the San Joaquin, and farther on came to a large stream answering in every respect the description. It is the one now known as King's river, and called on some of the maps Lake Fork, and is a hundred miles north of the place where Walker was encamped. This stream he ascended, and searched for a long time in a very rugged country, in many places covered with snow, but could find no trace of the party; and, thinking they had gone in to the settlement, he gave up the search and went to Monterey. It is possible (indeed almost certain) that Walker did not know of the existence of King's river when he was directing Colonel Frémont where to find him, for, when he arrived there on his way to Monterey, he mistook it for the San Joaquin.

Walker reached the pass late in December, and, passing the divide, made his camp in the valley of the stream flowing from it. Here he waited till the 18th of January, 1846, when he gave up all hope of seeing Colonel Frémont, and, his provisions being nearly exhausted, he started for the settlement, and subsequently rejoined the Colonel at Monterey.

From these circumstances the pass in which Walker and Kern were encamped was called Walker's Pass; and, as no name was known to Colonel Frémont for the stream which flowed from it, he named it Kern river. This stream was, and is now, known to the native Californians as the Po-sun-co-la, a name doubtless derived from the Indians. When I was at the ordinary crossing-place of the river, and preparing a small raft to cross, three Californians rode up to the opposite bank, and asked, in Spanish, if this was the Po-sun-co-la.

This pass, in which Walker made his camp, is undoubtedly Walker's Pass.

Colonel Frémont, in April of the preceding year, (1844,) had crossed the Sierra about half a

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degree south of this pass, and he may subsequently have concluded that the place he crossed was Walker's Pass, though I am not aware that he even so asserted.

In the year 1848 the notes of Colonel Frémont were compiled by order of the Senate. The work was done by Charles Preuss, and Kern's notes of this expedition were used in plotting Walker's Pass on his route of 1845, while Colonel Frémont's notes were used in plotting the pass on his route of 1844. Both trails are marked on the map, and make the matter perfectly clear. The most of these details were obtained from Godey and Preuss, and show conclusively that Colonel Frémont, up to this year, never was at Walker's Pass.

In the spring of this year (1854) he arrived at the eastern base of the Sierra Nevada, probably north of the 37th parallel. Finding it difficult to cross there, he was obliged to skirt along the mountains southwardly, till he came to a fine open pass, of the existence of which he was not previously aware, as the California papers announced it as an important discovery. I have conclusive evidence to show that this was Walker's Pass—the one just described—and of which Colonel Frémont could have known nothing definitely, as he had never been there before.

When it is asserted that *Walker's Pass* is an excellent one, and the person making the assertion refers to an entirely different place, the unintentional inaccuracy of the statement is due entirely to an ignorance of localities, and such ignorance is excusable when the localities are in a country so little known.

HUM-PAH-YA-MUP PASS.

Having completed the examination of Walker's Pass, in order to follow my original intention of tracing the water-shed of the mountains as near as possible, I found it necessary to retrace our steps down the Chay-o-poo-ya-päh for thirteen miles, till we came to the collateral valley before mentioned; for the mountains to the south of the pass were so high and rugged, that the only way to pass them was to turn them. We ascended this valley, which was about two miles wide. At first it was a broad bed of sand, which gradually contracted, and five miles up we found running water. There was an abundance of the bulrush growing here, and a large number of Indians, probably fifty or sixty, engaged in gathering it. They had evidently heard of us from their neighbors, and did not show the least sign of fear; but men, women, and children came flocking around us, evincing much curiosity. We camped among them, and the next morning Godey and myself started to examine the next depression in the mountains south of Walker's Pass. This we found to be about the same altitude as that pass, viz: about 5,300 feet, and the ascent a little steeper. It is not as open as the other, and hence is not as good a natural wagon-road. The average ascent for several miles is 288 feet to the mile. Like Walker's Pass, were the divide once passed, the further difficulty presented in the descent of Kern river is still to be encountered. It is about six miles in rectilinear distance from that pass.

TAH-EE-CHAY-PAH PASS.

Breaking up our camp on Hum-pa-ya-mup creek, we ascended this stream and crossed the divide, when we came upon the waters of a little stream flowing towards the basin. These small streams all have running water near their sources, but invariably become dry after running a few miles. The mountains here are thickly covered with brush; so thick, that, after an ineffectual attempt to proceed, we were obliged to return to the water and make camp, while Godey spent the afternoon in searching for Indian trails. He succeeded in finding one leading

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in the direction we wished to go, and the next morning we proceeded onward without difficulty. Our trail led over a series of spurs from the main mountain ridge, which we crossed twice during the day. Our altitude on one of these ridges was 5,500, feet and on our left was a high peak, towering above us from two to three thousand feet more. From this ridge was a steep and continuous descent for eight or nine miles, when we found ourselves in a beautiful prairie, apparently completely surrounded by high mountains, and, as far as the eye could tell, it was a horizontal plain. It was ten miles long, and from three to four broad. We came to an Indian rancheria, where we learned that there was a stream of water and good grass two or three miles further on. We proceeded to the place, and here found an excellent camping ground. This afternoon (August 17) we had a heavy thunder-shower, which lasted between two and three hours, and we all came into camp as wet as if we had been in a river. I could see no appreciable effect from it on the barometer. This is the only shower we had from the time of starting till late in November. There was another rancheria close to the place selected for our camp, and from the Indians we learned that their name for the creek was Tah-ee-chay-pah. It is the one called Pass creek by Colonel Frémont, and is the same one he ascended when he crossed the mountains in 1844. This camp was not removed for three days, the time being occupied in making examinations in the vicinity. We knew that the creek (upon whose headwaters we were encamped) flowed towards the Tulare valley, but we did not know at what point it entered it. We first went down the creek with the barometer, and found it emerged from the mountains about midway between Kern river and the Tejon. We descended the stream for 15½ miles, and found the average descent to be 157 feet. The creek was narrow, and, in many places, the mountains closed in, forming precipitous banks, while in others there was a valley half a mile wide. The hills, in many places, afford side-slopes favorable for making detours to gain distance and decrease the grade. The steepest grade found in any part was for a distance of 1½ mile, where it was at the rate of 192 feet to the mile. Timber was abundant.

From our camp, looking to the east and southeast, the hills (which we took to be the main ridge of the Sierra Nevada) looked quite low, and there seemed to be several depressions, which led us to hope we should find one, at least, favorable for railroad purposes. Being satisfied with regard to the creek flowing westward, we commenced an examination of the approaches from the Great Basin. We went first to a gap in the hills nearly east of our camp, and found it to present steep slopes on both sides; but pursuing our examination further, we were agreeably surprised to find that only a mile north of this gap was a break through the hills, through which the waters, collected in the eastern end of the prairie, discharge themselves into the basin; so that, in fact, the water-shed or divide of the Sierra was actually in the prairie itself, and the range of hills, mistaken for the main ridge, was, in fact, only a spur. A small lake-bed covered with an incrustation of salt is immediately at the entrance of this creek, and two miles further down we found springs of fresh water. There was a continuous bed of a stream, now dry, continuing into the basin, and the bases of the hills, on either side, were a quarter of a mile apart. The descent, for the first six miles, from the prairie, was at the rate of less than 80 feet to the mile, and further down it was more gradual. The height of the summit was 4,020 feet, and was the lowest point of the Sierra that I found. Altogether, the position and grades of this pass are more favorable than those of Walker's, and eventually proved to be more favorable than those of any other in the Sierra.

We next proceeded to examine the place where Colonel Frémont passed, and which was pointed out to me by Mr. Preuss, who was with him at the time, and subsequently plotted his notes.

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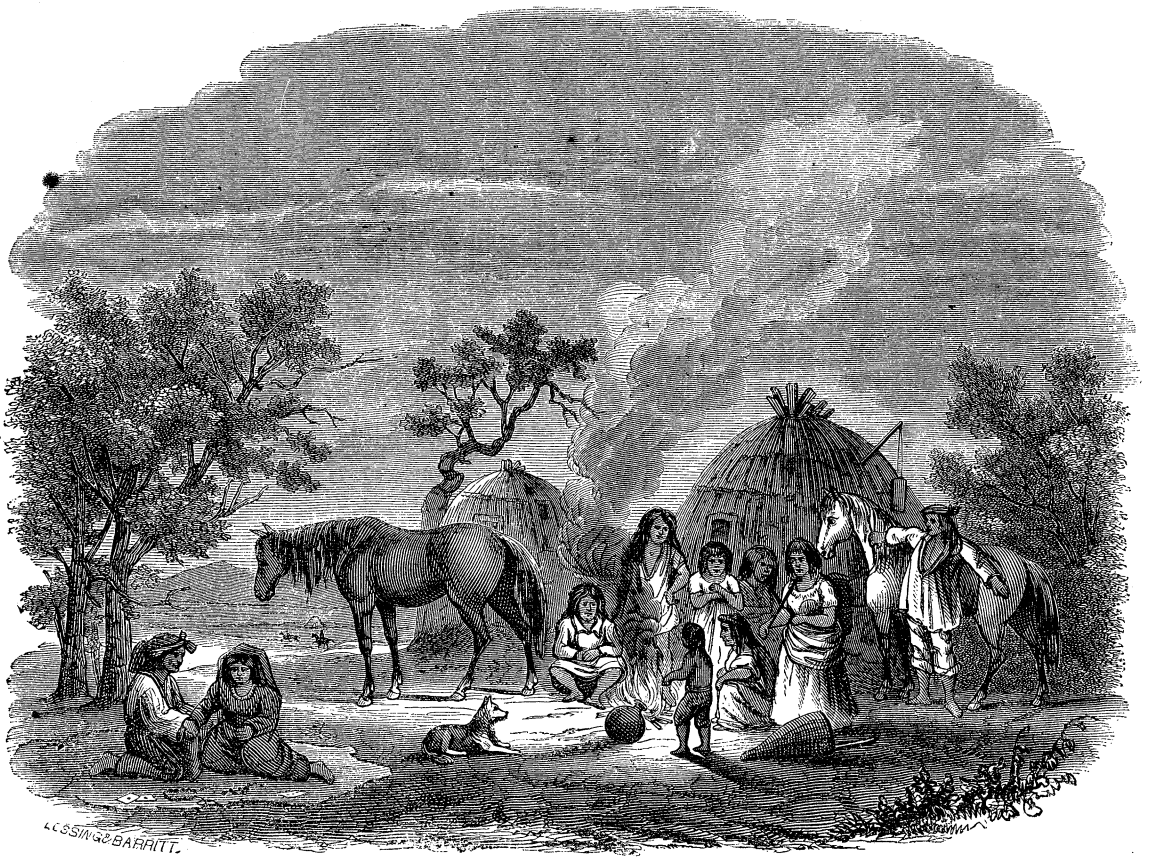
This point was in a southeasterly direction from camp, and was in a much more direct line to the Mohave river than the outlet of the prairie we discovered. In crossing the spur, however, we had to ascend about 600 feet in less than two miles. This point would be far preferable for a wagon road, being much more direct, and the ground, in wet weather, more solid than in the outlet. We ascended a high peak south of this point, and I gained a much better idea of the topography of the country than I had before.

It may be a question whether it would not be expedient to make a tunnel at this point, if a road is to come from the southeast, rather than follow the more circuitous course on a gentle grade. The distance saved would be from 12 to 14 miles. I am inclined to think that both time and expense would be saved by taking the longer route.

THE TEJON.

On the 21st of August we broke up our camp on Tah ee-chay-pah creek, and marched to the Tejon, which is the name given to the extreme southern portion of the Tulare valley lying immediately at the base of the mountains. The word is pronounced as if spelled Tay-hone, the accent being strong on the last syllable. The derivation of the word is uncertain. Whether it is taken from the Spanish word tejon, meaning a badger, or whether it is an Indian word, I am unable to say. The trail which we followed led us for ten miles through a series of prairies



TEJON INDIANS.

similar to, but smaller than the one we had left. We at first ascended slightly, till we came to a marshy place, from which flowed two little streams, the one to the north into Tah-ee-chay-pah

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creek, the other westwardly towards the Tejon. The western extremity of the last of these prairies was only 240 feet lower than the water-shed in the Tah-ee-chay-pah prairie, and the descent to the Tejon was made in less than five miles. The prairie abounded in springs, and the water, collecting at its western extremity, flowed through a precipitous ravine to the prairie. This ravine I examined with care, and subsequently went through it with the level; for I thought, if the calculations of the observations taken on Tah-ee-chay-pah creek should prove the grade down that creek to be too steep for a railroad, and it became necessary to resort to inclined planes with stationary engines, that this would be an excellent location for such constructions. I found the descent very steep, in some places over a thousand feet to the mile, and the average for a mile and a quarter was over 900 feet.

The Tejon is really a beautiful place. It receives several small streams, all of which sink shortly after leaving the mountains; but the ground being moist, produces fine groves of oak, and abundance of grass, and the green and fresh appearance of the spot presents a striking contrast to the parched and barren plain north of it.

Plate VI represents a part of the Tejon, with its timber, in which our camp was made. The gap in the mountains in the background is the entrance to the pass. The Indians here are semi-civilized; many of them speak Spanish; and they cultivate melons, pumpkins, and a little corn.

Three white men had also squatted here. They had made no improvement, however, but were waiting till they could perfect a title to the land. Northwest of the Tejon are two small lakes, known as Kern and Buena Vista lakes. The former receives the waters of Kern river, and discharges itself into the latter. These lakes are doubtless connected with the larger Tulare lakes. In fact, the middle of the valley from these lakes northward, to within 10 miles of the San Joaquin river, is, where it is not covered with water, a marsh, and is only passable during the dry season. Kern lake may properly be considered the head of the Tulare valley, and from it the ground slopes rapidly to the base of the mountains, where it has an altitude of from 1,500 to 2,000 feet above tide. I sent a barometer to the lake, and ascertained its altitude to be 398 feet.

Near the eastern extremity of the Tejon is a break in the mountains, known as the Tejon Pass. Through this break a wagon-road has been made leading to Los Angeles, and it is one of the worst roads I ever saw. This pass had been much and favorably spoken of as a railroad pass. About 15 miles to the westward is another pass, known as the Cañada de las Uvas, through which is a pack-trail, also leading to Los Angeles. We were assured by all, that between the two the mountains were much higher than at either of them. I therefore determined to go through the Cañada, and afterwards skirting the southeastern base of the Sierra, enter the Tejon Pass, and, following the wagon-road through it, return to the Tejon.

The Cañada de las Uvas appeared to the eye to be an excellent pass, and the barometer indicated its altitude to be much less than most of those previously examined. The Tejon Pass is a peculiar one. The altitude is quite great; but the ascent and descent appeared to be gentle, except very near the summit. It was hence supposed that, by means of a tunnel, the pass might be found to be a good one. From these considerations, and from the fact that the Tejon was confidently asserted to be an excellent railroad pass, I selected these two points for my experiment with the spirit-level, to get accurate profiles, and test the value of those from observations with the barometer.

The Cañada was supposed to be the last pass in the Sierra, as at or near this point it united

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with the Coast range. Still some vague Indian reports led me to suppose there might be one further west; and to be perfectly sure of having examined all that existed, I procured an Indian guide, and, leaving the Tejon, followed the base of the mountains westward for about 10 miles, when we came to a small stream. This the Indian assured us was the place, and we accordingly ascended it. We found the road very rocky, the ascent steep, and the altitude of the summit high. Upon descending from the summit six miles, we found ourselves near the summit of the Cañada de las Uvas. This at once proved the latter pass far superior.

Having thus most happily concluded the reconnaissance, during which data for the construction of six barometric profiles had been obtained, and the almost positive assurance that there existed no pass in the Sierra, south of Walker's, but those I had examined, I returned to the Depot camp on O-co-ya or Pose creek, where I arrived on the 29th of August, having been absent just twenty days—the exact time named at my departure. By a rather singular coincidence, the wagons arrived from Fort Miller on the same day, filled with the stores we required for future operations. Everybody was well in camp, suffering only from a desire for a more active life.

On the 1st of September we broke up camp, and marched to Kern river, where the rest of the day was employed in crossing the stores on a raft. Leaving this river for the Tejon, we went, in as direct a line as possible, across the open plain, our train of ten heavy wagons breaking down the bushes, and making a well-marked trail, six or eight miles shorter than the old trail, which followed the foot of the hills, and which has since been abandoned by the emigrants, they giving the preference to the one we made. Arriving at the Tejon, we selected a place for a depot camp, in a beautiful grove of oaks, surrounded by abundant grass, and near to the Tejon creek, and commenced our operations for surveying with the spirit-level. I detached Lieutenant Parke with instructions to make a hasty reconnaissance of the country in the direction of Los Angeles and its vicinity, hoping the information he would gain would be very valuable in deciding upon the most desirable course to be pursued in prosecution of the survey, as ultimately proved to be the case. We found Mr. Ed. Beale, superintendent of Indian affairs, at the Tejon, he having just arrived, after a long and arduous journey across the plains. A few days afterwards he selected this point for an Indian reservation.

TEJON PASS.

The surveying party, composed of Mr. Smith, Mr. Preuss, and myself, with the necessary rod-men, chain-men, &c., commenced, September 5, the survey of the Tejon Pass, the starting-point being the stationary barometer in camp, which had been placed in a brush-house open at the sides to admit freely the air, and was to be observed every three hours during the day. Mr. Smith took charge of the levelling party, while I, with Mr. Preuss, were working with chain, compass, and the barometer. Mr. Preuss made sketches of the hills and ravines on either side, so that his notes, in connexion with my compass bearings, would afford the means of making an accurate topographical map of the pass. The barometer was read, as a general rule, every quarter of a mile; but where any decided change in the uniformity of the inclination was perceived, that place was always made a barometric station. Mr. Blake made geological examinations, and connected them with the stations of the survey.

On the 18th September we returned to Depot camp, having completed the survey of the pass, and also of the ravine before mentioned, leading from the mountain prairie into the Tejon.

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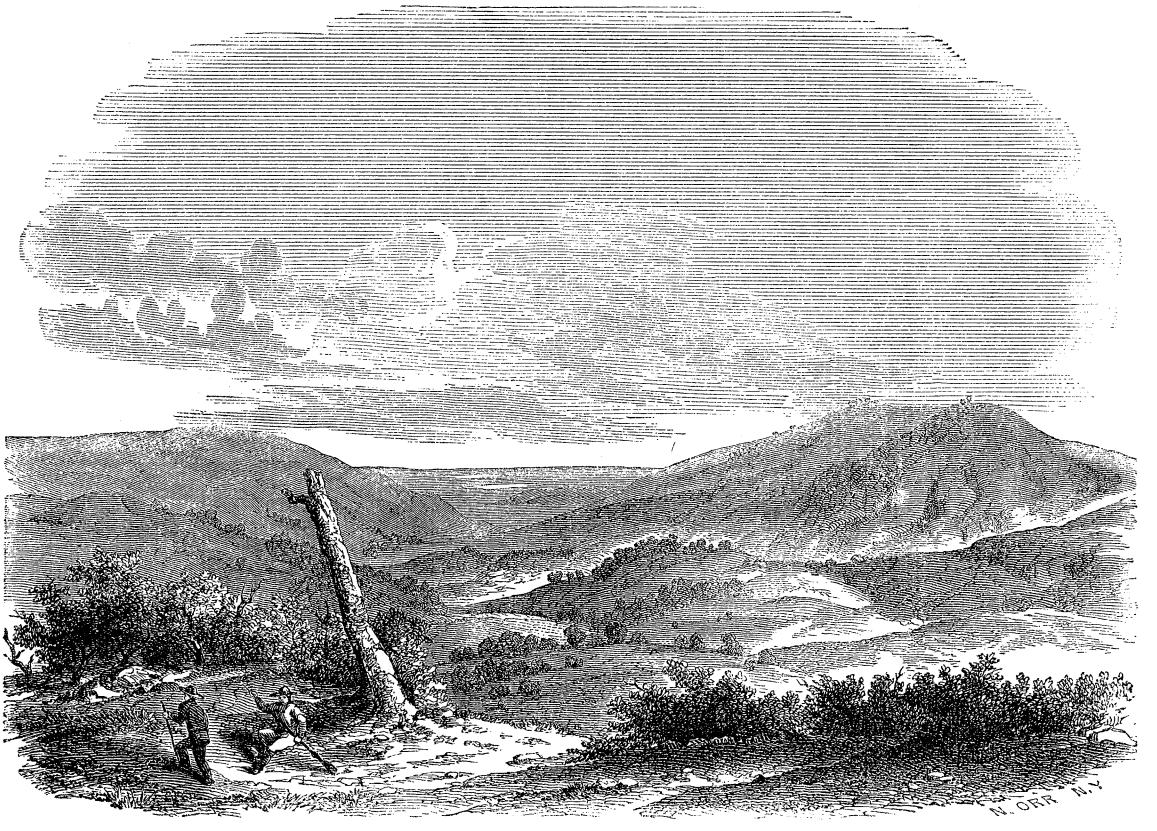
I will now give the results of the survey, merely mentioning here that the profile, as determined by the spirit-level and by the barometer, agreed remarkably well, seldom differing fifty feet, even with the ordinary mode of calculation, which is much less refined than if the minute corrections had been applied. This subject will be elaborately discussed in another place, and hence it is thought sufficient to mention here the simple fact, without further remark.

From the Depot camp to the point where the Tejon creek debouched from the mountains was a distance of two and eight-tenths miles, over unbroken ground. To the eye this appeared very slightly deviating from horizontality. The level showed a difference of altitude of 483 feet, giving a grade of 173 feet to the mile. The barometer made the difference of level 15 feet greater. I was surprised at this result, which taught that very erroneous impressions must generally be conceived with regard to differences of level if the eye alone is trusted to.

From the entrance of the pass to the point where the precipitous ascent before mentioned commences, and where a tunnel must commence, is a distance of eleven and four-tenths miles, and the difference of altitude was found to be 2,665 feet, giving an average grade of 234 feet to the mile, the minimum grade between any two stations being 150 feet per mile for half a mile, and the maximum being 383 feet per mile for nine-tenths of a mile. The barometer made the total difference of level 44 feet less.

The annexed sketch was taken from the crest, and the observer is supposed to be looking westward, through the valley of the pass, to the plains of the Tulare valley.



TULARE VALLEY, FROM THE SUMMIT OF TEJON PASS.

From this point, going eastward, we have an ascending grade of 2,207 feet to the mile, to the crest; then a descending grade of 728 feet, to a point on the eastern slope where the descent

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becomes less and more uniform, and which corresponds with the point above described, at the western base of this wedge-like summit. The horizontal distance between these two points is about 1.15 mile, which is the distance it would be necessary to tunnel.

From here to the point in the Great Basin where we left off levelling, the distance was 6.4 miles, at an average grade of 205 feet to the mile, the difference of level being 1,308 feet. The maximum grade between any two stations was 267 feet per mile for about half a mile, and the minimum 138 feet for nearly the same distance. The barometer made the difference of level between the two points 28 feet less.

SIDE RAVINE IN THE TEJON PASS.

The eastern terminus of the line was 3,388 feet above the sea, and was on the edge of the Great Basin. From here the ground assumes an unbroken appearance in the direction of a large dry lake-bed, about 25 miles distant and 1,000 feet lower. As this lake has probably no discharge, and is fed only by the drainage of the surrounding mountains after heavy rains, its altitude, 2,388 feet, may be considered that of the lowest part of this, one of those many subor-

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dinate basins which collectively compose that vast tract of country which has been named the *Great Basin.* As Kern lake is 398 feet above the sea, it appears that in this part of the range the descent from the summit of the Sierra to the head of the Tulare valley is nearly 3,000 feet more than the descent from the same point to the rim of the Basin.

The crest of the Tejon Pass is 5,285 feet above the level of the sea.

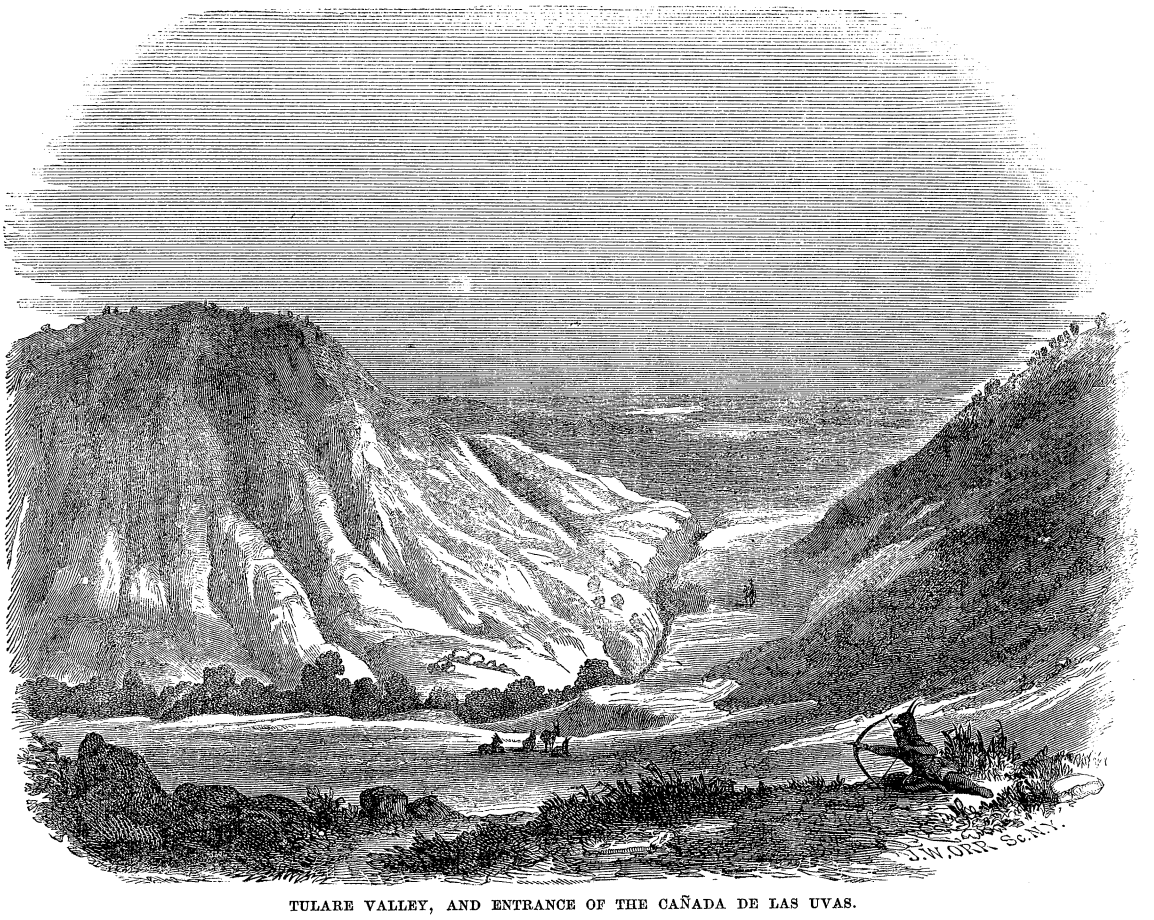
The grades in the Tejon Pass were much greater than I had anticipated, and, owing to the nature of the ridges, it is not possible to reduce them by side-cuttings. These difficulties consist in steep and rugged ravines, which furrow the mountains on each side and descend to the valley of the pass.

A view of one of these side-ravines from the trail is given in wood-cut on page 34.

I think the difficulties presented by the grades, taken in connexion with the tunnel that would be required, render this pass unfit for railroad purposes.

CAÑADA DE LAS UVAS.

Before commencing the survey of this pass, a line nearly straight was run across the Tejon to its entrance, to ascertain the absolute height above the sea of that point, assuming that the altitude of the Depot camp had been correctly ascertained. We found its altitude to be 193 feet above camp, or 1,640 feet above the sea.



TULARE VALLEY, AND ENTRANCE OF THE CAÑADA DE LAS UVAS.

This pass possesses some peculiarities worthy of note, for the line of survey may be said to go around the end of the Sierra Nevada, the pass being at the junction of the Sierra Nevada

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with the Coast range. The ridges of the latter curve around the southern end of the Tulare valley and form its boundary. At the foot of these ridges, and on the south side of the entrance to the pass, there are low rounded hills, much cut up by ravines, and often presenting precipitous banks, apparently of clay. (See Plate VII.) Mr. Blake describes these hills as of sedimentary origin, and of the age of the Tertiary.[1] After entering the pass, we ascend a stream flowing from it into the Tejon, fed by springs situated about half way to the summit.

In the ravine of this brook the bases of the mountains approach closely, forming but a narrow valley; but still ascending beyond the springs, the valley opens out to a plain from one-half to three-quarters of a mile in width, and the ascent is less steep. When quite near the summit, the ascent becomes more abrupt for a short distance. Descending from this divide, we come upon waters flowing into the Santa Clara river, and thence into the Pacific. Some distance beyond we come to another small divide, descending from the summit of which we are upon the waters flowing into the Basin.

From a short distance beyond the summit to the Great Basin, the valley of the pass is wide and bounded by low hills. Near our last camp in the pass the broad expanse of the Basin was visible, broken here and there by isolated ridges of barren rocks.

From the western entrance of the pass to the springs at the source of the brook, a distance of five and a quarter miles, the grades are quite steep, averaging 302 feet to the mile, the maximum being 348 feet, and the minimum 229 feet. From the springs to near the summit, the average grades are 121 feet to the mile, while at the summit itself there is for half a mile an ascent of 339 feet per mile, and for three-quarters of a mile a descent at the rate of 441 feet per mile. No difficulty is then experienced till we arrive at the second divide, which separates the waters flowing towards the Pacific from those flowing towards the Basin. Here we had a descent for half a mile at the rate of 357 feet per mile, after which the descent is gradual to the Basin.

The main difficulty in this pass is the very steep grade in the bed of the brook. The hills on either side are cut up by deep ravines—so much so as to prevent recourse to side-cuttings. The two divides are easily passed by tunnels from a half to one and a quarter mile in length.

There is a good wagon-road through this pass; and I learn that, since our survey, a military post has been established at or near the springs.

GENERAL REMARKS ON THE PASSES OF THE SIERRA NEVADA.

In the foregoing general description of the most important of the passes examined in the Sierra, I have spoken of only the most important features of each pass, giving their grades, and endeavoring to explain the position and peculiarities of each, so that a general comparison may be made. This was all that was necessary, as the accompanying tables give in a concise form full and minute information, as also the data from which this information was obtained; and these tables, in connexion with the maps and profiles and the sketches, form a complete description of the passes. I think the facts which have been brought forward warrant the following conclusion:

Of the five principal passes described, there are two which are pre-eminently superior to the others, viz: the Tah-ee-chay-pah Pass and the Cañada de las Uvas. As far as the situation of these passes is concerned, neither has the advantage if the road comes from the Mohave or the mouth of the Gila; for, taking a point on the map near which such a road must pass, and

[1] Vide Report upon the Geology of the Expedition.

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measuring from this point the sinuous course through each pass to the probable crossing of Kern river, it is found that the two routes are almost exactly the same in length. Water is equally abundant in each, but timber abounds most in Tah-ee-chay-pah. But the main point of comparison is the grades. In Tah-ee-chay-pah we have 157 feet to the mile for fifteen miles; in the Cañada we have 302 feet for five miles and two tunnels. I imagine, from the little statistical information that I have been able to obtain, that this last grade, though perhaps not positively impracticable for locomotion, would present such serious difficulties that the Tah-ee-chay-pah Pass would be considered by railroad engineers as decidedly the preferable.

THE GREAT BASIN.

On the 5th of October, the survey of the Cañada being completed, we returned to Depot camp. Lieutenant Parke had returned some days previously, and had assisted me in the field-work in the Cañada. His hasty reconnaissance proved very useful, having gained a general idea of the country; and also, from information gained in Los Angeles, he had visited a pass in the Coast range east of that pueblo, situated between the two high mountains of San Bernardino and San Gorgonio, which presented a very favorable appearance. This pass was little known, and had never been considered in connexion with a railroad.

Having concluded the survey of the passes in the Sierra Nevada, my instructions were to ascertain the most direct practicable railroad route to the mouth of the Gila. The direction of the mouth of the Gila from these passes is southeast, and the intermediate country had been represented as a desert. Rumors of parties having attempted to cross it and never having been heard of were common, but no one could be found who professed to have any personal knowledge of it. We knew, however, that the direct route between the two points must cross the Mohave river, distant, in a direct line, about one and a half degree.

I considered it important to examine this district, and also to examine the passes in the Coast range. To accomplish both objects, I determined to go out into the Basin, till I arrived midway between the Sierra and the Mohave, and then, returning, strike over to the mountains. After arriving on the Mohave I could from there come towards the Sierra, and connect with my former line. This plan being adopted, Lieutenant Stoneman, with the escort and wagon-train, left the Tejon, and passing through the Cañada de las Uvas, (where we had made a wagon-road,) followed the base of the Coast range, and camped near the pass of San Francisquito. Lieutenant Parke, with a small party, was sent to the northward in the Sierra, to obtain information required to complete the general map of the passes, and Mr. Blake and myself started to make an examination of the Basin. From the summit of the Sierra, in the Tejon Pass, we had an extended view, which gave a good idea of the formation of the country towards the east and southeast. From the base of the Coast range northward is a belt of undulating land, from 15 to 20 miles wide, and unbroken by any peaks. North of this belt is a system of isolated peaks and short ridges, known as lost mountains, and which, as they extend north and east, increase in height and become worthy of the name of mountain ranges.—(See Plate IX.) These ranges often enclose extensive areas which are destitute of peaks, and in the lowest part, where the water accumulates after heavy rains, is a lake-bed, without water in the dry season.

Having gone through the Tejon Pass, we took our course for the nearest of the lost hills, distant from the base of the Sierra about ten miles. Here we were rather surprised to find several springs of fresh water. These springs formed little streams, running from ten to fifty yards, and then disappearing in the dry soil. Continuing onward in nearly an easterly direc-

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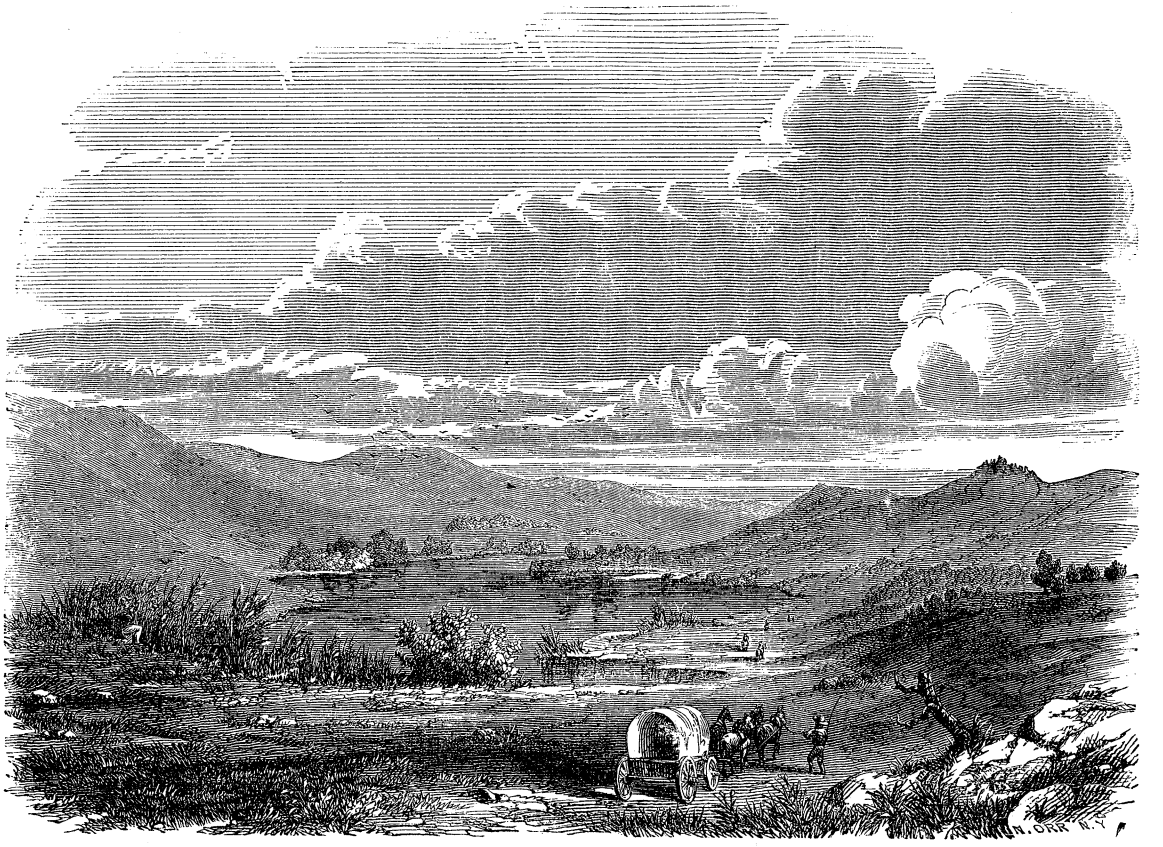
tion for about ten miles, skirting the base of a chain of lost hills, which were about 600 feet high, we came to another spring, and a few miles beyond we found a third. We ascended several of the hills to get views of the surrounding country; and finally, after having gone about thirty miles east of the base of the Sierra Nevada, we turned back and rejoined Lieutenant Stoneman in camp.

Subsequently, I came westward from the Mohave river to near the place where we turned back, and found the country presented the same characters, except that no more water was discovered. Independent of the lost hills, the country is a system of inclined plains or slopes; and although there is no serious topographical impediment to the construction of a railroad through it, the grades would often approach 100 feet to the mile. There is no timber, the surface being generally bare, or covered with sage bushes, grease-wood, yucca trees, &c. Mr. Blake confidently expresses the opinion that water can be obtained by boring.

SAN FRANCISQUITO PASS.

Lieutenant Stoneman's camp was near the entrance to the San Francisquito Pass, a pass through which the wagon-road from the Tejon descends from the summit of the Coast range to the Santa Clara valley. He had found no difficulty in conducting the wagon-train through the Cañada de las Uvas, and along the base of the mountains to camp, finding plenty of grass and



LAKE ELIZABETH, SAN FRANCISQUITO PASS.

water at short intervals. I made a survey of the San Francisquito Pass with odometer and barometer, and found it very difficult for railroad purposes, there being a grade of 457 feet for a mile, and over 330 for two miles. The wagon-road passes along and in the bed of a mountain

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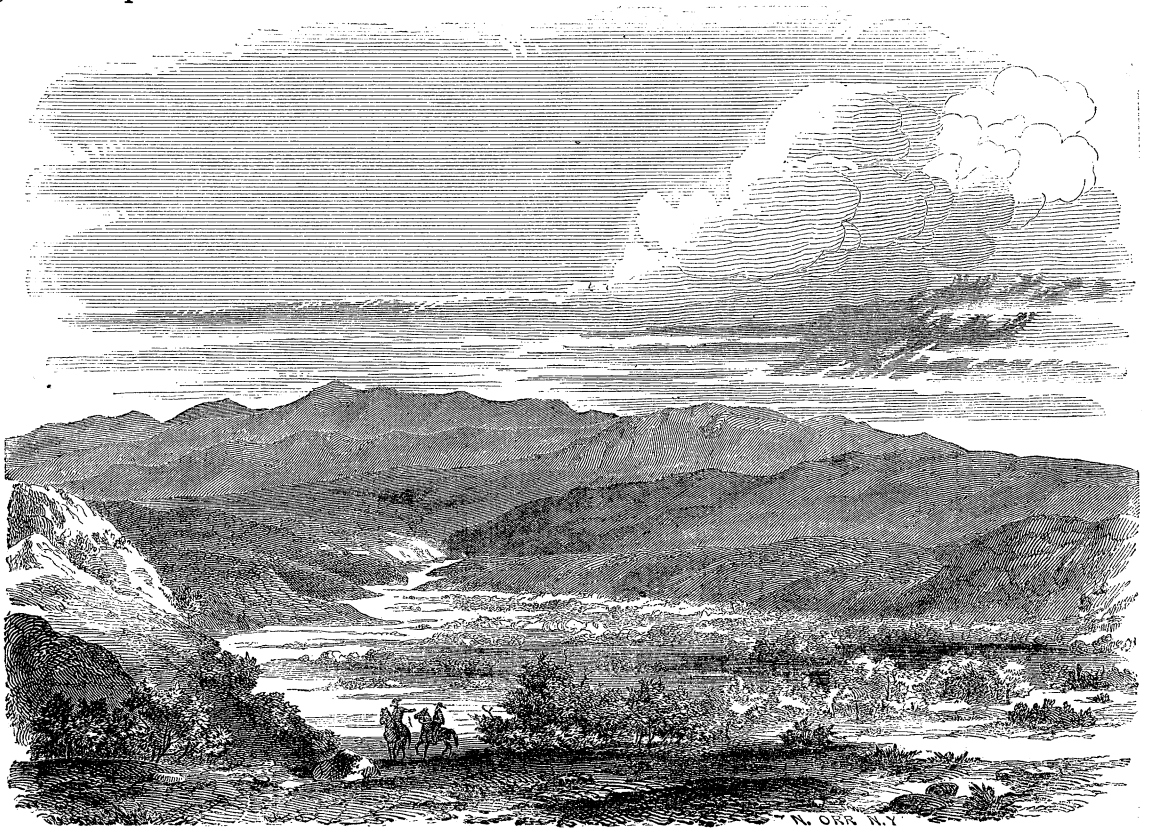
stream, in many places passing through rocky cañons, where expensive side-cuttings would be necessary. For these reasons I considered this pass as of no importance.

The approach to this pass from the Great Basin, by the wagon-road, is over an outlying ridge, which extends parallel with the main divide, and thus forms a long narrow valley. This valley is occupied by a chain of small lakes, which are bordered by a luxuriant growth of grass.

NEW PASS.

Returning to camp with the intention of advancing to the Mohave river, I was induced by Lieutenant Stoneman's report to ascend a high mountain near camp, from which a fine view of the Santa Clara valley could be obtained; and for this purpose the camp remained in the same place another day. The mountain is the one named on the map Stoneman's mountain, and we found it by aneroid measurement to be 6,000 feet high. From this great elevation we had a very extended view. In a westerly direction we saw the valley of the Santa Clara spread at our feet, the many low hills of that valley giving it almost the appearance of a plain. On the north of the valley was the Coast range; on the south a branch range from the latter known as the Susannah range; while in the valley between, a branch of the Santa Clara was traced, winding its course towards the sea. On the northwest was the Sierra, and on the northeast the Great Basin. Many bearings were taken which afterwards proved useful in plotting the general map.



ENTRANCE OF NEW PASS.

It was proposed to descend the mountain on the side opposite to that we ascended, and to return to camp by going around its southern base. This plan was adopted, and by doing this

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we reached, in an open spot, the branch of the river. Following this branch to its source, we were quite surprised to find the depression in the mountains here very low, and the pass, thus found, to be open, and apparently of quite gentle and gradual acclivity. As the existence of this pass was supposed previously to be unknown, I named it New Pass; and though not surveyed till some time subsequent, I will now describe it.

From an accessible point in the Great Basin, nearly eight miles from the divide, the survey commenced, and followed the course of a long open valley leading to the crest. This valley is represented in the annexed wood-cut; the crest or divide is not, however, visible, being between the ridges at the extreme right of the picture.

From the point in the Basin at which the survey commenced until we arrived within a mile and a third of the crest, the grades were below 50 feet. Here we found half a mile at 218 feet, and four-fifths of a mile at 240 feet per mile. These grades can easily be reduced by either excavation or winding to gain distance. Commencing the descent we have 77 feet for $1\frac{8}{10}$ mile, on an almost perfect inclined plane; $3\frac{2}{3}$ miles at 105 feet; and all the rest of the descent far below 80 feet per mile—the greatest being 78 feet for $1\frac{3}{4}$ mile. I may safely say that the descent in this pass can be made without having it at any point a grade as great as a hundred feet. The survey was made with odometer and barometer, and there was no obstruction for the wagon, except for a short distance, occasioned by trees. This pass leads into the Santa Clara valley, near where the wagon-road through the San Francisquito Pass enters it, from which point there is no obstruction to the ocean. I believe this was the first time a wagon had ever been taken through this pass.

Returning from Stoneman's mountain, we continued our route with the train for the Mohave. We were obliged to skirt the base of the mountains to find grass and water, neither being known to exist in the Basin. We found several springs, but finally, after a long march, camped on a bold stream which was a river in the foot-hills, but sank immediately upon reaching the Basin. It is marked on Preuss' map from the surveys of Colonel Frémont; but as we knew no name for it, we called it Johnson's river, after the soldier who found it for us.

The next day our march was very slow and fatiguing to the animals, as the country was filled with yucca trees and bushes, and no road had been broken. Fortunately, about dark we came to a small stream, where our thirsty mules obtained water. Had it not been for this, I think many would have given out. We stopped here a few hours to allow them to rest and eat a little barley that we had saved, and also to get supper for ourselves. Then travelling all night, we reached the Mohave the next afternoon. It was a great relief to all when we struck the "old Spanish trail," for then, the road having been broken, we had no more bushes to contend with. We made a depot camp where that trail strikes the river, October 19, 1853.

So far we had succeeded in progressing towards the mouth of the Gila, but we were by no means sanguine of future success. The country we had passed over from the passes in the Sierra, though very trying to us, presented no impediment to the construction of a railroad, water being obtained by digging, and the total right-line distance about 150 miles. But there were unknown mountains to be examined and crossed before we would be at our destination.

MOHAVE RIVER.

The three days subsequent to our arrival on the Mohave were spent in examining the country in different directions, so as to form a proper plan for our future movements. Every peak in the vicinity which seemed likely to afford an extended view was ascended, and the conclusion was

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arrived at, that from this point there was no chance of proceeding to the southeast, and that we must, to attain our object, follow the river till an available point to leave it in the desired direction should be found. I detailed Lieutenant Parke to ascend the river, to endeavor to find a practicable pass at the source of one of its branches, while I should descend it for a similar purpose; and, as the services of Mr. Smith, on this survey, could be dispensed with, he was given a party, with the spring-wagon, to make a survey of the New Pass, examine the country lying between it and the Cajon Pass, and after a survey of this latter to return to camp. It was estimated that Lieutenant Parke and myself would be absent ten days, while Mr. Smith would require a few days longer to accomplish his surveys. Lieutenant Stoneman, with the escort, was to remain in camp.

I started with a very small party, on the 23d, down the river. At Depot camp it was a broad, shallow stream, abundantly wooded, and its bottom confined by terraces on either bank, from one to three miles apart. The water, however, soon sank in the sandy bed, reappearing generally at a point of rocks, or a contraction of the stream. The timber followed the direction of the water, and generally disappeared with it.

After descending about twenty-four miles, I made one of my camps at a rocky point where the water flowed freely, but only for a short distance. Here, the course of the river not being discernible, I was in doubt whether to follow the wagon-road, which I had no reason to suppose would leave water, or to go through an opening more to the south. There was but little choice between the two, and finally I determined to take the road. After travelling ten or twelve miles, I discovered that neither of the courses was the correct one, but that the river flowed through a cañon in the intermediate hills. Returning, I made camp at a place on the river conveniently situated, from which to make a reconnaissance of the southernmost opening.

As there was little chance of finding water after leaving the river, I took with me a pack-mule, carrying two ten-gallon kegs of water, by which means I was able to go thirty or forty miles and return. I started early, with two men, leaving the other two in camp, and proceeded in the direction of a high peak in a ridge ahead, which ridge seemed to terminate the opening. As we advanced, however, we found this to be a mere spur, extending into the opening, and not closing it. About sunset, I fortunately found a little dry grass, and being at the foot of the ridge, I made camp. As, by ascending the peak, I would be able to see a great distance in every direction, whereas my provisions would not allow of following the opening, I resolved to attempt its ascent, and, starting very early, succeeded in gaining its summit by daylight. Here I had an extended view. There were ranges of hills and mountains on all sides, which seemed to have no uniformity of direction. In a direction south, 25° east, the hills seemed to be more distant and lower. They looked white, like sand-hills, and were about twenty miles off. I could form a pretty good idea of this distance, as I could compare it with the distance from camp, both places being visible from where I stood. The direction of these low hills is about the same as that of the mouth of the Gila, which was distant 175 miles, and the nearest point of the Colorado river 125 miles.

I arrived at noon where I had left the men, and, having given our animals the last of the water, we turned our faces towards camp, where we arrived late at night.

About midway between the peak and camp was a singular isolated hill about 300 feet high. It was composed of very black volcanic rock, and its form that of a very symmetrical truncated cone, surrounded at its base by a circular horizontal bed of the same rock, the cone being in the centre. This bed was between two and three miles in diameter, its edges well marked, and

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rising from two to six feet above the surrounding gravelly plain. I regretted very much that I could not stop to examine and ascend it; but, as it was, I was fearful our mules would give out before reaching camp. From its peculiarly symmetrical appearance, from the volcanic nature of the rocks, and from its singularly isolated position, every one must be struck with its similarity in appearance to a volcanic crater.

The next morning I moved up the river to a point I had selected, from which I intended to go out into the Basin towards the Tejon, to connect with the partial line before described. The only point in the Mohave bottom from which the Tejon mountains can be seen is about 25 miles below Depot camp. This is due to the terraces and low hills on the river's bank. From here I went to a low point of hills, about 10 miles towards the Tejon, and finding the nature of the Basin to be of the same character as heretofore described, and being perfectly satisfied of its practicability for a railroad route, I retraced my steps, and finally returned to Depot camp on the 1st of November.

Lieutenant Parke returned from his examination up the river on the same day. He reported that he explored the headwaters of the river, and found the mountains near its source to be exceedingly high and rugged. The precipitous ravines and side-slopes were of such a nature as to render travelling on muleback very difficult and often impossible. This reconnaissance demonstrated the impracticability of crossing the mountains east of the Coast range, and near the headwaters of the Mohave, and at the same time it furnished much useful topographical information.

The result of these preliminary examinations seemed to force the following conclusions, viz: 1st. That it was positively impracticable to reach the mouth of the Gila by ascending the Mohave, and crossing the mountains east of the Coast range. 2d. That for 60 miles at least below the Depot camp there were ranges of hills and mountains south and southeast of the river, which presented an impassable barrier to progress in a direct course towards that point. The evident deduction was that a circuit must be made either to the west or to the east to turn these mountains.

Under these circumstances it was determined to divide the party into two parts. Lieutenant Parke, with the wagon train, was to cross the Coast range at the Cajon Pass, and recross it at the Pass of San Gorgonio, thus turning the headwaters of the Mohave river and the high mountain of San Bernardino, in which it has its source. Being thus once more east of the Coast range, he was to follow along its eastern base till he came to Warner's Pass, where he was to select a camp and commence the survey of that pass. In the meantime the second party, with pack-mules only, would descend the Mohave river to its supposed junction with the Colorado, and thence down that river to the mouth of the Gila. This latter party would be accompanied by the whole of the escort, as we knew the Indians on the Colorado to be numerous.

While waiting for the return of Mr. Smith and his party, preparations were being made to follow out this plan, and numerous observations were taken to establish astronomically the position of this, one of our most important camps.

Mr. Smith returned on the 6th of November, after a successful expedition, the results of which will be detailed hereafter. Early on the morning of the 8th the wagon train started, and shortly after the packs were ready, and we were on the trail down the river. On the evening of the 10th we made our camp at the lowest point I had reached on the river during my preliminary examination. From here we followed the broad river-bed for 15 miles, having

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clay bluffs on each side, when we entered the cañon, which is about seven miles long, and had running water throughout its whole length. The bed of the stream in the cañon is from 100 to 150 feet in width. On either side the clay bluffs rise often over 100 feet. They are vertical, and, by the action of the water, the surface has in many places assumed the form of Gothic pillars. The clay presents every variety of beautiful and delicate tints—purple, pink, blue, yellow, &c. In the cañon we found cane growing, similar to that mentioned as found in Walker's Pass, and large quantities of it had been cut by the Indians. We saw, however, no fresh Indian signs.

Upon emerging from the cañon, we entered a sandy plain, and at once lost all signs of the river-bed. After travelling 13 miles across this plain, we were fortunate enough to find a hole containing water, and here we made our camp late at night. The water was barely sufficient for our nearly exhausted animals, and a long time was occupied in giving them a scanty supply. This plain had an abundant growth of mezquite trees. We afterwards found some uninhabited Indian huts near here, and saw an abundance of old Indian tracks, but no Indians.

In the morning, upon taking a survey of our position, we found we were near the centre of an irregularly shaped plain, surrounded by hills. To the southeast appeared an opening, and here we concluded was the outlet through which the Mohave continued its course. We went in this direction about thirteen miles, the first seven or eight of which were over low sand-hills; but afterwards we travelled in the dry bed of a wash, which we found we were *ascending*. Being convinced that we had left the Mohave, and the men who had been sent in search of water having been able to find none, we returned to our camp of the morning. This was another very fatiguing day for the animals, and after reaching camp, there being so little water in the hole, which filled very slowly, it took till 2 a. m. to water them. We observed to-day that to the north of our camp was a large lake-bed, and here we inferred the waters of the Mohave were collected. The question now was, whether this lake had an outlet, or whether it was a basin, and the terminus of the Mohave. To ascertain this point, Lieutenant Stoneman and myself started to examine the lake, which was about fifteen miles long, and covered with an incrustation of salt, exceedingly bitter. We, however, returned to camp late, without any positive result. Not being willing to move the command upon an uncertainty, I resolved to devote one more day to examination. To the east of our camp was a high range of barren mountains, its crest from fifteen to twenty miles distant. Lieutenant Stoneman and myself ascended to the summit of one of the nearest peaks, from which we had an extended view. To the eastward were to be seen nothing but mountains; we saw, however, that to the northward of the salt lake, and not far distant from it, were several other lake-beds. Our view to the southward was bounded by mountains.

The result of these examinations was, that if the Mohave flowed beyond the salt lake, it could flow in no other than a northerly direction through these lake-beds, and the only thing to be done was to proceed in this direction, though directly contrary to the one we wished to go.

We had found at the base of the hills, on the edge of the salt lake, several fine springs, slightly brackish but not unpalatable. Around these was good grass. The camp was moved here, and the animals were refreshed by once more having as much to eat as they wanted.

On the morning of November 16, at 5 o'clock, we started by fine moonlight and travelled to the northern extremity of the salt lake, and thence on to the next one. We found the two connected by a ditch, cut by water in the clay soil, and about twenty feet wide, with banks two feet high. The two lakes were from three to four miles apart. The second one was six miles

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long and three broad. The character of the second lake was entirely different from that of the first. It was a dry, hard clay-bed, on which the shoes of the mules scarcely made an impression; while the other was covered with salt, and in many places too soft to travel over. The bases of the hills on the west, and the mountains on the east, were immediate on the lake bank, and as we crossed it we could see there was no outlet in either of these directions; but to the northward the hills were low, and we expected to find here a passage where water could flow. On arriving at the north end of the lake, we found a very low ridge, connecting the hills on either side. We searched for a passage through this ridge, but could find none; but everywhere saw, in the gullies, that the water from rains flowed towards the lake. I hence concluded that the true sink of the Mohave river was in the salt lake, and that the second lake was formed principally from water flowing from the surrounding hills after heavy rains; but that in time of very high water in the salt lake, its surplus flowed through the ditch before mentioned into it.

We crossed this ridge, and at once descended into another valley some two hundred feet lower than the bed of the lake. After travelling four or five miles, we came suddenly upon a wagon-road. We knew it could be no other than the old Spanish trail, and this at once afforded proof that the Mohave river of the maps is a fiction. It was universally supposed by emigrants and others, that when the Spanish trail left the Mohave above the cañon, it never was on it again. The valley in which we struck the trail extended to the northward twenty or thirty miles, bounded on all sides by mountains.

We were now, according to our estimates, over 100 miles in a direct line from the Colorado, with a mountainous country between, and neither wood, water, nor grass that we knew of. To attempt to reach that river would have been madness. Our only alternative was to turn back. We took the wagon-road, and at midnight reached Agua de Tomaso, having travelled fifty-five miles without water.

Agua de Tomaso, (or, as I am told, more properly Agua de Tio Mes,) is simply a spring of bitter water, which does not flow more than a hundred yards, and is quite different from what maps generally represent it to be; for they often make it a stream 20 miles long. There was not enough grass here to subsist our animals, and we were, therefore, obliged to push on early in the morning to where the trail strikes the Mohave. From here we went by the usually travelled roads through the settlements to join Lieutenant Parke, whom we found near Warner's rancho, at Agua Caliente. We joined him on the 29th of November, and once more all the party was together.

MR. SMITH'S SURVEY.

I have deferred until now a report of the results of the survey intrusted to Mr. Smith, because I did not wish to interrupt the detail of facts connected with the Mohave river.

Mr. Smith left Depot camp on the 21st of October, with the spring-wagon and a small surveying party. Instead of following our circuitous trail, he attempted to go in a direct line to the entrance of New Pass, but found the ground cut up by gullies, and the yucca trees and brush very thick. He therefore regained the road, and, proceeding without further difficulty, arrived at and went through the New Pass. A full description af this pass has already been given.

On the south of the Santa Clara valley is a spur of the Coast range, running obliquely towards the sea, and known as the Susannah range. In order to pass from this valley to the valley of Los Angeles, this range must be crossed or turned. The latter course is easily pursued, as the range degenerates into low hills as the sea is approached; but this would greatly

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lengthen the road. The wagon road of the San Francisquito Pass crosses this range at a pass known as that of San Fernando, as it leads directly to the mission of that name. It was through this pass that Mr. Smith went, and I will now describe it:

SAN FERNANDO PASS.

Two small streams, rising near the crest of the Susannah range, and one-quarter of a mile apart, flow in opposite directions—the one north into the Santa Clara, the other south towards the mission of San Fernando. Between the two is a sharp crest, where the inclination is over 1,000 feet to the mile. This is the nature of this pass, which is only $8\frac{3}{4}$ miles from base to base. Leaving the Santa Clara, we ascend $2\frac{2}{3}$ miles, at the rate of 43 feet per mile; then $1\frac{1}{3}$ mile, at 260 feet per mile, which brings us to the base of the crest; having passed which by a tunnel, we descend $4\frac{1}{2}$ miles, at 157 feet to the mile, to the southern foot of the pass. With a tunnel, this is decidedly practicable. The only question is, as to the expediency of increasing the length of the tunnel to reduce the grade of 260 feet. The Susannah range has been very little explored, and it is not improbable that other passes in it may be found presenting much less difficulties than this one.

Once arrived at San Fernando, the country may be traversed in almost every direction between that point, San Bernardino, and the coast.

About 21 miles southeast of San Fernando is the Pueblo de los Angeles, formerly the capital of California, when under Mexican rule. This place is celebrated for its delightful climate and fertile soil. Large quantities of grapes are exported to San Francisco, and considerable wine was formerly produced. The accompanying view (Plate X) was taken from a hill near the city.

From this place Mr. Smith passed over an interesting and fertile country to the valley of San Bernardino, and acquired much valuable topographical information. This portion of the route, surveyed by Mr. Smith, is perfectly practicable for railroads, and therefore I proceed at once to a description of the Cajon Pass, which he surveyed, and which leads from the San Bernardino valley, through the Coast range, towards the Mohave.

CAJON PASS.

The general direction of this pass is nearly north and south, the base towards the Pacific being more easterly than the summit. In approaching the summit from the Mohave there is no appearance of ascending a mountain. With the exception of a few low hills or undulations on the crest, it is apparently a continuous inclined plane. Arriving at the crest, we are at the summit of a very steep hill, descending which we come into the bed of the Cajon creek, 836 feet below the summit. The road then follows the creek down to the San Bernardino valley.

The survey commenced at the Pacific base, about 14 miles from the summit. For the first $6\frac{1}{2}$ miles the average grade was less than 100 feet, and for the next $6\frac{1}{2}$ less than 200 feet, averaging 165 feet to the mile. The ascent of the steep hill is now commenced. We ascend for 0.96 mile, at the rate of 534 feet per mile, then 0.23 mile at 1,271 feet, and arrive at a point 40 feet below the crest. In the descent from the crest we have $2\frac{1}{4}$ miles, at 207 feet per mile; after which is a nearly uniform slope of 90 feet to the mile to the Mohave river, distant from the summit 19 miles.

It is evident that the mountain here can only be passed by a tunnel. Taking the grades as given above with the corresponding horizontal distances—which were deduced from odometer measurement—to be correct, it is found by calculation that if we start a tunnel from the creek

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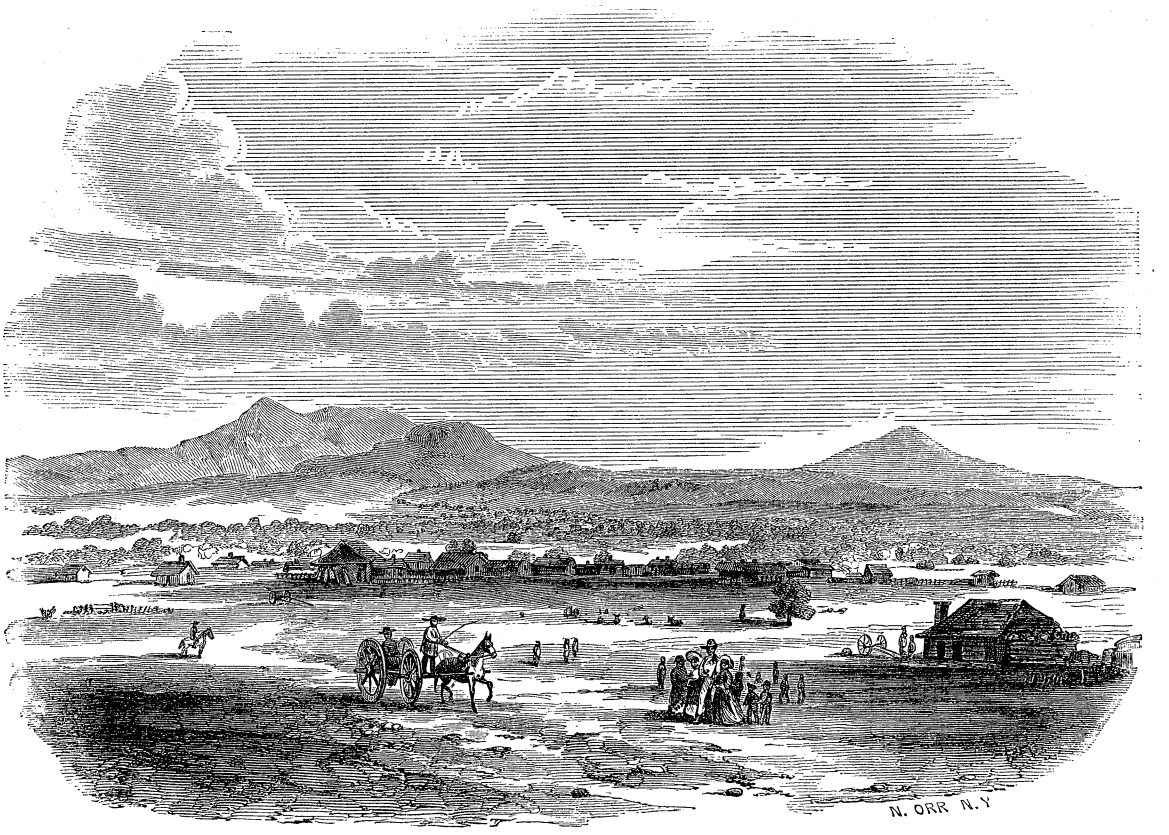
at the base of the steep hill, with an ascending grade of 100 feet to the mile, the length of such a tunnel would be 3.4 miles. Such a tunnel would emerge on the eastern slope at a point below all steep grades, and from its eastern extremity to the Mohave no grade exceeding 90 feet would be required. In the Cajon creek the grades would be steeper, but probably could be much reduced by taking advantage of the side-slopes.

The survey of the Cajon Pass finished the work assigned to Mr. Smith, and the information he obtained was very valuable. His note-books show that his work was done in a very thorough manner.

LIEUTENANT PARKE'S ROUTE—SAN GORGONIO PASS.

On the 8th November, as before stated, the party was divided. The results of the expedition down the Mohave have already been detailed. Lieutenant Parke, with the wagon-train, passed through the Cajon without difficulty, and reached the Mormon settlement of San Bernardino, a flourishing little village near the mountain of the same name.



MORMON SETTLEMENT IN THE SAN BERNARDINO VALLEY, WITH A VIEW OF THE PEAKS OF SAN BERNARDINO AND SAN GORGONIO.

Having procured supplies here, he proceeded through the pass of San Gorgonio, thus once more arriving to the eastward of the Coast range. The pass was surveyed, and proved to be a very good one.

The high mountain of San Bernardino is the highest in the Coast range. Its height is not known with accuracy, but approaches 9,000 feet. Southeast of this mountain is the peak of San Gorgonio, nearly as high. These two mountains, whose peaks are 30 miles apart, approach each other at their base, and the open pass between is known as the pass of San Gorgonio, and

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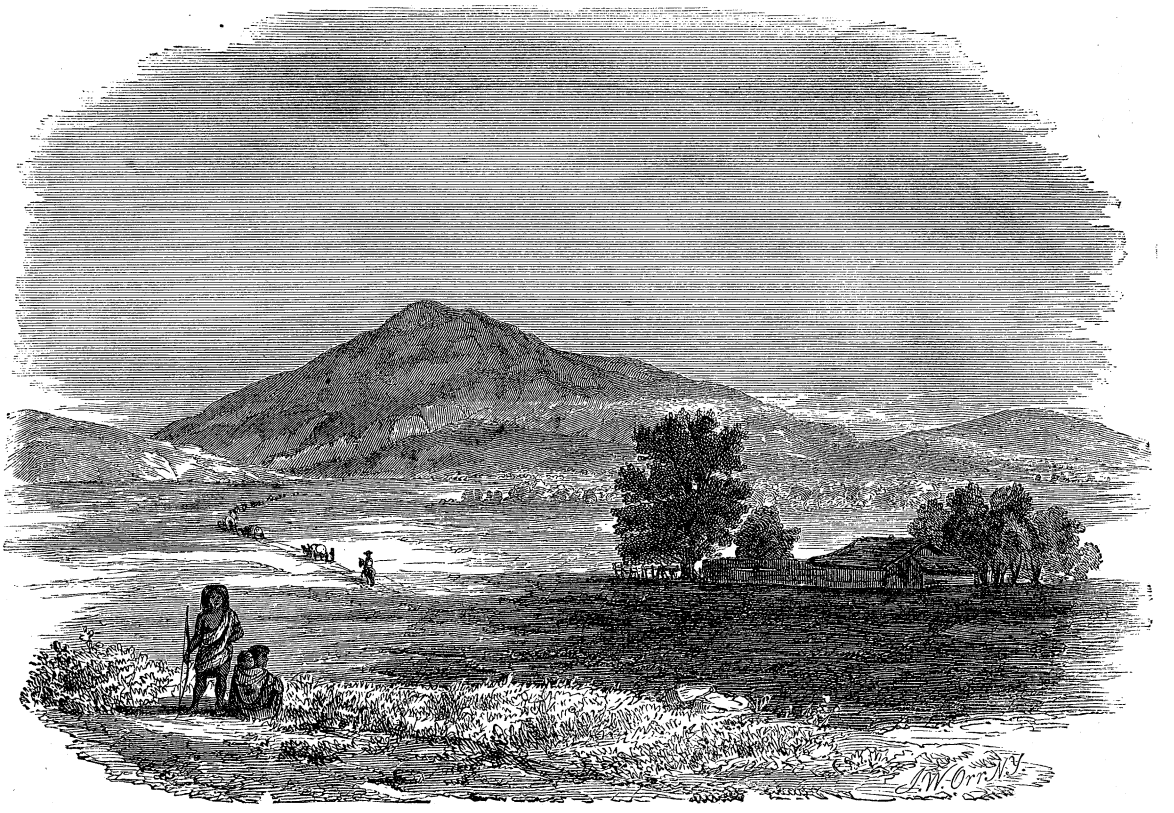
is one of the lowest in the Coast range, being but 2,800 feet above the sea. This pass, if named after one of the mountains, would more naturally take the name of the more prominent one; but it doubtless received its present name from that of the rancho, the land in the pass being styled in the Spanish grant the "Rancho de San Gorgonio."



SAN GORGONIO MOUNTAIN.

The above sketch represents Weaver's house, near the summit of the pass; the foot-hills of San Bernardino mountain are seen on the right.

The survey of this pass was commenced on the Santa Anna river, about two miles from the Mormon settlement. From here the line of survey followed up a dry branch of that river, and, passing the divide, descended another stream, dry except near its source, to the desert. The grades in this pass are so uniform that it is difficult, in its description, to say anything more than to state the degree of declination to be overcome. After ascending for $6\frac{1}{4}$ miles, at a grade of 45 feet to the mile, we have $18\frac{1}{4}$ miles to the divide, at an average grade of 78 feet; during the whole of which distance, with the exception of $1\frac{1}{3}$ mile at 127 feet, the greatest deviation from the average is eight feet per mile. Descending from the divide, we have 28 miles at an average grade of 69 feet. This pass is so uniform and open that it may be considered the best pass in the Coast range.

Having gained the eastern base of the mountains, Lieutenant Parke conducted his train along their base till he struck the wagon-road leading to Fort Yuma. Along the first part of the route the country was inhabited by friendly Indians. It was evident that here the land was below the level of the sea, and that they were travelling in the bed of what was once either a lake, or the head of the Gulf of California. Water was obtained near the surface by digging; a distinct water-line was visible on the rocks, and the barometer indicated a depression below

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the sea-level of nearly 100 feet. It is highly probable that further from the base of the mountains the depression would have been greater. As they approached the wagon-road the ground was very much cut up by gullies, which, doubtless, would have been avoided by keeping further from the foot-hills. It was necessary to keep close to them, however, as the only chance of procuring water.

A mountain range extends from San Bernardino mountain in a southeasterly direction, nearly if not quite to the Colorado. Between these mountains and the mountains on the Mohave nothing is known of the country. I had never heard of a white man who had penetrated it. I am inclined to the belief that it is a barren, mountainous desert, composed of a system of basins and mountain ranges. It would be an exceedingly difficult country to explore, on account of the absence of water, and there is no rainy season of any consequence. I was informed by the commanding officer at Fort Yuma that there they usually had but one rain during the year, which fell in August.

The country included between the mountain above mentioned, the Coast range, and the Colorado, is level, or but slightly undulating, and is known as the Colorado Desert. In many parts it is destitute of vegetation.

Lieutenant Parke having struck the wagon-road, crossed the Coast range at Warner's Pass, and encamped near Warner's rancho, at Agua Caliente, where we joined him on the 29th of November.

It now only remained to examine the passes in the Coast range leading into San Diego, and the desert between the mountains and Fort Yuma, to complete the work which had been assigned to me. As far as I could ascertain, the only passes known to the citizens of San Diego, and advoe cated by them as suitable for railroad routes, were Warner's Pass and Jacum Pass. The latter was supposed to lie partly in Mexican territory. It was known that, even if the mountains were once crossed at Warner's Pass, it would be impossible to follow the wagon-road to San Diego, and that another route must be found. In Warner's Pass a creek rises and flows towards the Pacific, but where it empties was not known. I instructed Lieutenant Parke to descend this creek to its mouth, and then proceed along the coast to San Diego, where he would gain as much information as possible with regard to the passes in the mountains; and should the Jacum Pass be favorably spoken of, to proceed to its examination, and then return to San Diego. In the mean time I intended to cross the desert to Fort Yuma, and expected to return and arrive at San Diego about the same time. The services of the escort being no longer required, Lieutenant Stoneman, with the wagon-train, proceeded at once to San Diego.

WARNER'S PASS.

In order to have the means of measuring distances with the odometer, and also to carry barley for the mules, I took a wagon with me to Fort Yuma. We started on the 1st of December; Lieutenants Parke and Stoneman both starting at the same time on their respective routes. Our route lay through Warner's Pass to the desert, and thence across to the Colorado. Warner's Pass had already been surveyed by Lieutenant Parke, and I will now describe its prominent characteristics.

Leaving Warner's house, we reach the actual summit of the Coast Range in five miles, and in ten miles more we arrive at a little valley called San Felipe. The drainage of the valley is through a narrow, rocky cañon, the mountains on each side rising precipitously, and being covered with huge blocks of granite. This being impracticable for a wagon-road, the trail is

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led over a collateral divide, 400 feet above San Felipe, and is brought upon the headwaters of another creek; it then follows this creek to the desert, continually descending, with the exception of half a mile, where it crosses a hill to avoid a cañon of the creek.

From Warner's to within $2\frac{1}{4}$ miles of the summit the grades are easy; but from here we have $1\frac{1}{4}$ mile at 215 feet per mile, and 1 mile at 280 feet per mile. Descending from the divide we have a grade of 333 feet for $1\frac{1}{3}$ mile, and of 140 feet for 4 miles more. Suppose we connect the point where the ascending grade of 280 feet commences, with that where the descending grade of 333 feet ends; we should have a tunnel $2\frac{1}{2}$ miles long, with a grade, descending towards San Felipe, of 100 feet to the mile; and to reach such a tunnel we have to overcome a grade of 215 feet per mile.

Having arrived at San Felipe, a road might be made through the cañon above mentioned, with immense labor and expense. It would have to be built on the side-hill, and there would probably be required from 10 to 15 miles of road of the most expensive character to reach the valley at the lower end of the cañon; for although this cañon is but little more than four miles long, the fall averages at least 400 feet to the mile.

PASS BETWEEN SAN FELIPE AND VALLECITO.

But if the cañon be rejected, and the route at present pursued by the wagon-road be preferred, we must ascend from the valley of San Felipe, and cross the collateral divide between that valley and the headwaters of Carrizo creek. To do this we have a gentle ascent till near the divide, when a tunnel of 300 yards would be required to pass the steep pitch, where the ascent is at the rate of 940 feet and the descent 740 feet per mile. Having passed the divide, the wagon-road lies in the bed of the stream, dry during the greater part of the year. The descent

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